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RAILWAY BRIDGE, NEAR YORK, ENGLAND.

We publish herewith a view of a fine railway swing bridge, erected over the river Ouse, near York, England, by the North Eastern Railway. We are indebted to *Engineering* for the illustration of the structure, which consists of three openings, namely, one fixed span of 107 feet over all, and a double swing span of 176 feet over all, leaving a clear opening for vessels of about 62 feet, the river being navigable for small craft some distance above the bridge.

The swing portion of the bridge is supported on a pier of cast iron situated on the north bank of the river, this pier being composed of one central column 7 feet in diameter, containing a hydraulic accumulator, and eight supporting columns each 4 feet in diameter carrying the roller frame and path. The weight of cast iron in the pier, exclusive of the foundation cylinders, is about 280 tuns.

The swing portion is formed of two main girders, 176 feet in length and 14 feet in depth between flanges over the swivel pier, where they are connected together at the top by cross girders, carrying a platform, from which is regulated the working of the bridge. The flooring is composed of 23 transoms, 26 feet long and 1 foot 8 inches in depth, which, over the pier, are covered by $\frac{1}{2}$ inch plating, the rest of the floor being formed of bars 8 inches by $\frac{5}{16}$ inch, with openings of 1 inch.

The girders and flooring of the fixed span are of the same form as those of the swing portion. The total weight of wrought iron in both swing and fixed spans collectively is 401 tuns.

The swing portion is moved by means of hydraulic machinery giving motion to a pinion geared into a circular rack.

The superstructure of the bridge was designed by Mr. J. E. Harrison, and erected by Messrs. Pease, Hutchinson & Co., of Darlington, the hydraulic machinery being devised and applied by Sir William Armstrong & Co., of Newcastle on Tyne.

California's Growing Industries.

A correspondent of the New York *Times*, writing from California, states that the mining interests continue prosperous, and most of the leading mines are doing well, taking out a good quality of ore, and paying dividends. Many of the lesser ones, however, continue to levy assessments (Irish dividends); but that must necessarily be the case where no working capital is set aside for the purpose of carrying on the work of development. "It takes a mind to work a mine" is amply illustrated; but it is the history of nearly all the present dividend-paying mines. They all had to travel the old beaten tract, and occasionally relapse into their former condition. It is expecting a good deal of a mine to continue paying for an endless period of time, when we consider the fearful drain upon it to produce daily from 100 to 500 tuns of ore. It cannot be expected, you know. Take the Crown Point and Belcher, for instance. These two mines have produced, on an average, five hundred tuns daily for several years. A tun of ore is six cubic feet, and a hundred tuns makes a big hole. They have taken out forty-six millions of dollars in the last four years, and are now down in the bowels of the earth some sixteen hundred feet. If anything were wanted to prove the theory that the center of the earth is a mass of seething molten matter, the intense heat in the lower levels of some of our deep mines would be conclusive evidence. In the lower galleries of the Ophir, for instance, before the recent air shafts were completed, the heat was so intense that the shifts of men had to be changed every two hours. (When I say "shifts," I speak in mining parlance.) Occasionally they got a gush of hot water that made things lively for them. After all the fuss about the great value of our agricultural products being superior to the mining interests, the grain production has only exceeded that of mining some four millions. In the earlier days we never dreamed that California would prove an agricultural country, and we relied only upon mining; but the two interests together are pretty good. It would be difficult to name a country, with the same population, producing its equal in value—ninety-six millions in four years, that we have a record of, to say nothing of the large aggregate of the Chinese product, and that of individuals, of which we have no record, at least four millions more—say one hundred millions in total, or an average of two millions a month, and constantly increasing. California is not such a bad country after all. Wait about five years, and you will see its product doubled. Another evidence of our prosperity is the constantly increasing manufactures. We shall soon be able to supply nearly everything we require, thereby retaining in the country the money that we have heretofore sent abroad. Conspicuous among the recent enterprises, I can mention the establishing of jute bag factories, more woolen mills, and a watch manufactory. The Cornell Watch Company, of Chicago, has been transferred to this place, and will soon be in operation—the advantages being an even temperature and Chinese labor. The Chinese are probably the most intelligent and skillful people for any such purpose that can be found; quick to learn, always reliable in their work, doing a thing always alike, never striking for higher wages, never going on a spree, quiet and tractable; and they are particularly skillful where nice manipulation is required. The Watch Company will employ about 150 men, and the advantages of cheap labor will be manifest over Eastern labor in these particulars, to say nothing of the difference in price. The company were paying on an average $3.25 per day, while they will be able to obtain better operatives here at $1.25—a saving of $2 per day, less the difference between gold and currency—not much, either, when we take into consideration that their receipts will be in coin. The company will find a large outlet for their cheap watches in China and Japan, the natives of those countries being much addicted to purchasing timepieces. Every Chinaman purchases a watch. They want to know about what time they may expect to be pelted with brickbats and mud balls by the enterprising young Americans, who are inculcated at an early age in this entertaining sport.

RAILWAY BRIDGE NEAR YORK, ENGLAND.

Scientific American.

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Contents.

(Illustrated articles are marked with an asterisk.)

THE LARGEST YET.

We print this week two editions of the SCIENTIFIC AMERICAN, the combined issue of which reaches the large number of One Hundred and Ninety Thousand copies. The quantity of paper required for the two editions is Five Hundred and Thirty Reams, and the weight, Thirty-Nine Thousand Seven Hundred and Fifty Pounds—little less than Twenty Tuns. We believe this to be the largest circulation of any paper of its class ever issued in a single week.

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With this issue, the time for which a large number of our subscribers have prepaid, expires. In order that our readers may experience no stoppage in the receipt of the journal, and that we may not miscalculate the quantity of the paper to print at the commencement of a new volume, we hope our friends will signify their intention to continue the paper by early remittances.

The plan of discontinuing the paper when the time expires for which it is prepaid, we think preferable to the course, adopted by many publishers, of continuing their paper indefinitely and collecting afterwards. The latter course is too much like having a bill presented for a suit of clothes after it is worn out. We shall be gratified to have every old subscriber renew, and doubly grateful if each will send one or more new names with his own.

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ANOTHER NEEDED AMENDMENT OF THE PATENT LAW.

By the present law, the grantee of any interest in a patent has ninety days within which to file his conveyance for record. If he complies with that rule, his rights are determined by the date of his deed. This furnishes abundant and unnecessary opportunity for fraud, and often imposes great hardships on innocent and careful purchasers.

He who after full examination finds the title of a patent complete and unencumbered often feels safe in paying his money therefor, and in making extensive arrangements for engaging in the manufacture thereof. Ninety days thereafter he may learn that an assignment one day older than his has just been filed in the Office, and has rendered his title worthless. This ought not so to be.

In some of the States of the Union, the registry laws relative to the conveyance of real estate have had a like provision, but experience has shown the inexpediency of such a rule. Priority of right is now generally given to the purchaser who first files his deed for record. This is a wise regulation; for if some one must suffer wrong, good policy as well as justice dictates that it should be the negligent rather than the vigilant. Is not this an equally sound maxim as applied to the sale of a patent?

At all events, the ninety days now allowed to the purchaser of a patent is much too great. No great mischief would result from allowing such a purchaser hardly time enough to send his deed to the Patent Office. If he failed to do this, his rights should be postponed to those of any other *bona fide* purchaser whose deed was first on record. A rule of vigilance similar to that which is observed in order to charge the indorser of a protested promissory note might best protect the just rights of both purchasers, and would furnish little room for injury of the kind above referred to.

But there is a still more crying evil of a similar character. A license under our present law need not be recorded at all. A *bona fide* purchaser, who has waited ninety days before paying the purchase money or doing any other irrevocable act, may afterwards find, to his dismay, that there are licenses in existence, running the entire lifetime of his patent and covering the whole scope of his conveyance, which is thus rendered wholly valueless. Opportunities for successful wrong are here presented, for which there is no excuse. They are unworthy of the intelligence of the age and country. The hand of reform should be applied here without delay.

GOVERNMENT MONOPOLY OF THE TELEGRAPH LINES.

The argument of Mr. G. P. Lowery, before the Congressional Committee, in opposition to the Hubbard Postal Telegraph bill, contains much forcible reasoning. Whether or not Congress has the right to make telegraphic intercommunication a government monopoly is clearly a constitutional question, based upon the interpretation of the sections which confer upon the national legislature the power to establish post offices and post roads, and to regulate commerce. The advocates of the scheme hold that, under these provisions, Congress has the necessary power, and urge that the telegraph must be regarded in similar light as the mails; if the government has the right to monopolize the dissemination of information through the carriage of missives in the latter case, it has the same right through the transmission of signals in the former. The opponents of the bill, including all the present private telegraphic corporations, deny the above premises, and draw a wide margin of difference between the establishment of the post offices and roads and that of the telegraph. They maintain that the post office is simply the medium through which the government tenders itself to carry parcels of a limited weight for a limited price, and this entirely regardless as to the contents of the parcels, whether the same be a means of transferring ideas from one person to another, or a mere mass of material substance. The telegraph, on the other hand, is *per se* a medium for transmitting information, and nothing else.

Mr. Lowery elaborates these views with much ingenuity and cogency in his argument. He points out that the post office is an agency, the original design or motive of which was, doubtless, to favor the transmission of intelligence, public or private, between the people: its function is the carrying of packages which *may* contain information. Because this possibility exists, and Congress controls the means of conveyance, therefore it is urged by the advocates of the plan that Congress should control another medium which conveys nothing, but merely transmits information as such—a clearly illogical sequence.

To borrow Mr. Lowery's illustration: Suppose A and B are talking together a couple of feet apart. A crosses the street, and the conversation is still maintained by raising the voices; or one person may go to the garret and the other to the cellar of a house, and yet converse through a speaking tube. They may separate by a wider interval and talk by pre-arranged signals made with their arms; or lastly, they may place an interval of a thousand miles between them, and still continue their remarks by the aid of the telegraphic wire. A's mind meets that of B just as instantly through the telegraphic signals as through the medium of oral words. In the one case a conducting wire, through which a current passes, is the means; in the other, sound-conducting air, through which certain vibrations are transmitted, serves the same purpose. The extension of the telegraph, then, from between A and B to between every individual in the United States and everywhere else, virtually places all the people within the sound of each other's voices. If such were literally possible, then—if the government has the right to control batteries and wires in the one case—it has equally power to control the vocal cords and air in the other: in other words, to prevent people talking to each other save on the payment of tax—a *reductio ad absurdum* too palpable to need further demonstration. Of course the power once in the hands of any government to control interchange of information between the people converts that government into a despotism very different from that contemplated by the Constitution. That instrument, however, is a rigid one; and as it distinctly says "establish post offices and post roads" and "regulate commerce," and does not say anything about controlling information (however transmitted), it may be taken as reasonably certain that no judicial interpretation would discover in the plain provisions above quoted the degree of elasticity necessary to extend them to an authorization to Congress to assume the ownership of the telegraph lines.

There are many, however, who would be willing to yield a point of right, if the expediency of the change were great. That is, if, by suppressing the private corporations and placing the telegraph under government control, the whole country would be manifestly benefited, not many would be found to oppose any legal means, if such could be reached, for accomplishing the object. But here again we are met by an array of considerations and facts which demonstrate the project to be plainly inexpedient. The latest reports of European government telegraphs show clearly that, instead of being a source of revenue to the countries where the system has been adopted, they are a source of expense. Statistics for 1873 show for the German Empire a deficit of $661,727. France has a very slight surplus; but taking the aggregate receipts of seven countries—Germany, Hungary, Belgium, Denmark, France, Holland, and Switzerland—the expenditures are found to have exceeded them by $1,075,510. As for England, the London *Railway News*, of late date, admits a deficiency of $5,000 a week, and this increasing.

In adverting to this subject before, we pointed out that a comparison of the British tariff with our own, taking into consideration the enormous distances between points in this country, shows in the end that our rates could gain little in cheapness supposing our government to run the telegraph at once as efficiently as that of England now does. Again, the English post office carries letters for a penny, and makes five million dollars a year; ours charges three cents, and, according to Postmaster Jewell's report, there is a deficit of eight million dollars. The Postmaster General may well assert his intention to try and make the receipts and expenditures of the Department bear some proper relation to each other; and we may justly doubt even the accomplishment of this task for some time to come. It is absurd, however, to suppose that, beside this, a postal telegraph could be made into a paying enterprise, and not an additional burden on the taxpayers. There are other objections to the postal telegraph which we have not space here to detail. A government censorship of news is not to be desired in these days of high party feeling; nor is the saddling of the country with an immense host of new officials an inviting prospect—particularly when appointments will probably, as is the case now in other political positions, be governed by every other consideration save that of fitness for the work. The imposition of another tax is also objectionable. The telegraph is not employed by a great mass of the population. As it is now, it costs this class nothing; as it would be, they would be obliged to contribute to its support.

Postmaster Jewell's report, to all appearances, gives the postal telegraph scheme its practical quietus for this session; but as the project is nevertheless likely to be brought up and discussed, it is, perhaps, well that the public should understand wherein it fails both in law and in expediency. If the government chooses to erect or acquire telegraph lines for its own use and benefit, it certainly has the right to do so; but that it should compel the people to employ only those lines, by legislating the great telegraphic corporations out of existence and securing to itself the monopoly, we decidedly disbelieve.

THE TRANSIT OF VENUS.

Cable despatches from three of the American expeditions for the observation of the transit of Venus, respectively stationed in Japan, Siberia, and Tasmania, and from the British parties in India, China, and Egypt, announce the results thus far obtained. Professor E. Hall, telegraphing from Vladivostock, reports that, as the planet advanced and touched the sun's limb, the moment was signaled with accuracy; but owing to the drifting of haze and clouds between, it was impossible to obtain good photographs of the contacts. After Venus had crept half way across the sun's disk, however, thirteen good negatives were secured, so that it will be possible to map the planet's track on the photographic image of the sun after the observers return home. Professor Davidson, at Nagasaki, was also troubled with cloudy weather. The first contact could not be recorded, but the time of the second one was obtained excellently. A large number of accurate measurements were secured, however, and sixty clear photographs. The astronomers of this party were remarkably fortunate, as almost immediately after the occurrence of the phenomenon the sky became thickly clouded.

Messages from the British parties to the Astronomer Royal state that at Thebes, Egypt, numerous fine photographs were taken; and at Cairo and Suez, the closing stages of the transit were viewed under favorable auspices. The reports from Shanghai, China, are discouraging, and announce complete failure of all attempts, owing to the cloudy weather. The Indian observations seem to have been the most successful, upwards of one hundred negatives of the planet's position on the sun's disk being secured. The details of the micrometric measurements and of the instants of contact, it is also stated, were obtained with precision.

Professor Harkness, from Hobart Town, Tasmania, announces bad weather, but good results, in the shape of one hundred and thirteen photographs.

Altogether the reports are encouraging, and point to generally fair success. The despatches of Professors Harkness and Hall are the most important, owing to their stations being far north and far south of the Equator, and hence giving the most trustworthy data.

In this connection we notice a letter, from Mr. Lewis M. Rutherford, to the *Times*, in which he recommends the use of a short telescope and enlargement of the image by the intervention of an enlarging lens between the objective and the plate on which the photograph of the sun is taken, in lieu of

a long telescope, some forty feet in length. Mr. Rutherford's great success in solar photography, as well as in the photographical record of the positions and aspect of other heavenly bodies, entitle his opinions to the highest consideration; and since his suggestion to the above effect has not been adopted by our observers, the details of the results obtained by using long telescopes will be looked for with interest. If there be any error or difficulties due to the latter cause, it would be a matter of grave public regret that Mr. Rutherford's advice had not been heeded.

Professor C. S. Lyman, of the Sheffield Scientific School, has published an interesting communication detailing telescopic observations of Venus, made from the observatory of the above institution just before the period of transit. When the planet arrived at a distance of only half the sun's diameter from the sun's limb, its appearance became no longer that of a crescent but of an entire ring of light, beautifully delicate, and brightest on the side toward the sun. It is only when the conjunction occurs very near the node that the planet can approach near enough to the sun to have the horizontal refraction of the planet's atmosphere, on the side opposite to the sun as seen from the earth, deflect the solar rays so as to bring them to the observer.

It is to be hoped that other astronomers have watched this interesting phenomenon: for beside its beauty and novelty, it affords, with proper measurements, the means of determining the refractive power of Venus' atmosphere, which would appear to be about one sixth greater than that of the earth.

THE PATENT OFFICE CLERKS.

We are informed by a Washington newspaper that the Commissioner of Patents is proposing to have the force in his office increased without increasing its expenses, by diminishing the pay of some of the old employees sufficiently to provide salaries for the new ones. We hope this statement is untrue. That the present rate of compensation in the Patent Office is not too great is proved by the fact that it is insufficient to secure the desired permanency in official station therein. When a clerk has acquired the experience and skill that qualify him for the effectual discharge of his duties, he soon finds some more lucrative employment elsewhere. These situations are thus often regarded as stepping stones to the real business of life, and are vacated as soon as the incumbents have fitted themselves for usefulness therein. This state of things will grow worse the more the rate of compensation is diminished. As the higher grades of these clerkships require the highest order of talent and skill, they should be made the object of ultimate ambition and desire to those holding subordinate positions. These should not, therefore, be induced to seek more inviting situations elsewhere, in consequence of inadequacy of compensation here.

If, therefore, a larger number of employees is needed, let them be employed and fully paid; if they are not needed, they ought not to be employed at any price. It is a false economy to fix the scale of official salaries so low that they will not command proper qualifications in their incumbents, and it is almost an equal mistake to cumber the rooms and halls of the Patent Office with those whose services are not needed. Let all be diligently employed and fully paid.

If we are not misinformed, there are already nearly or quite five hundred persons now on duty in the Patent Office. With proper regulations, and under a well arranged system of labor, we believe that this number is fully sufficient for all the business that will be brought before the Office for many years to come. The funds of the Patent Office have been contributed by the inventors of the world, and should be devoted to their benefit. It is due to them that this fund should not be wasted or needlessly expended. If it is now more than sufficient to meet the annual expenses of the Office, a diminution of the office fees would be a proper corrective; but it ought never to be squandered on a multitude of officials who are willing to serve on half pay.

EZRA CORNELL.

Just as the reports of the astronomers scattered over the remotest portions of the globe, telling of the observations of a great natural phenomenon, are flashing over the wires, the sad intelligence reaches us of the death of the man to whom, next to Morse, the world is indebted for the introduction of that grandest of modern inventions, the electric telegraph. The immediate associate and co-worker with the inventor, his firm adherent through all the dark hours preceding the triumphant success of the derided project, the name of Ezra Cornell will pass to posterity as indissolubly linked to the telegraph as to the noble university which remains a monument to his benevolence and philanthropy.

Mr. Cornell was born at Westchester Landing, New York, on January 11, 1807. His youth was spent working at the potter's trade with his father, but little opportunity being afforded him to acquire more than the rudiments of a common school education. On attaining his majority and for fifteen years thereafter, he was at times a workman in machine shops and at times engaged in agriculture, earning but a slender income. In 1843, he became acquainted with Morse, and at once deeply interested himself in the plans of that inventor. At that period Morse was seeking a practicable way of laying his wires through underground pipes, and called in Cornell's aid to assist him. Cornell soon invented a machine for accomplishing the work, which was successfully used until it was decided to abandon the underground system in favor of the poles. It is related that this decision was not arrived at until two thirds of the Congressional appropriation, for constructing the experimental line between Baltimore and Washington, had been expended, and it was evident that the balance could not complete the undertaking. Morse then called Cornell aside, and told him that operations must be stopped, but in such a manner that the public would not suppose that they had failed. Cornell at once grasped the handles of his machine and started the eight mules by which it was drawn ahead at a lively pace. By an adroit turn of the wrist when unobserved, he ran his plow point against a rock, wrecking the apparatus, thus demolishing the only means by which the pipe laying could be continued. Subsequent experimenting resulted in the success of the wire elevated on poles, as is well known, but the labors of the inventor and of his faithful friend to raise funds to extend their projects were none the less unremitting. So hard-pushed were they at one time that they opened a show of their instruments in a store on Broadway, asking a small admission fee; but the public failed to appreciate the chimerical scheme, and the revenue of the partners was very small. Cornell was almost penniless, entirely so at one period, as he afterwards stated that the lucky finding of a shilling in the street prevented his going dinnerless.

With the general recognition of the magnitude and importance of the invention, Mr. Cornell began to reap the returns for his zeal in its behalf. He was employed in the construction of many telegraph lines, through which means, together with the increase in value of the shares of stock which he owned in the Western Union line, he speedily amassed a large fortune.

The early part of his life is a lesson of frugality and perserverance; his closing days furnish a shining example of liberality and benevolence. He struggled until he attained wealth; but riches once gained, he abnegated self, and devoted them to the welfare of mankind. His first public act of philanthropy was the endowment of a public library in Ithaca, New York, on which he expended some fifty thousand dollars. Then followed the magnificent gift, first of $500,000, then of two hundred acres of land with the necessary buildings, and finally smaller donations amounting to $11,000, to found Cornell University, one of the few great educational institutions which aim to teach men to keep themselves, to send out skilled mechanics, graduates capable of earning their bread at once by their own work, not mere book-worms, as ignorant of the world as of how to make it support them.

Mr. Cornell for many years took an active part in politics, filling with honor several State legislative offices. He was also President of the State Agricultural Society, and was largely interested in many railroad, banking, and manufacturing companies. His fatal illness, which terminated on the 9th of December, was induced by overwork in business affairs.

WILL DO IT AFTER A FUNERAL.

It is now considered settled by the most eminent medical authorities that a large percentage of the sickness which prevails in cities, like New York, is due to the backing up of foul gases through sewer pipes into the apartments of dwellings. Against these dreadful odors, the pipe traps commonly used offer but little protection.

There is a very sure and simple remedy, which at a slight cost might be applied in every house in New York; but which, we are sorry to say, is rarely put into use until after there has been a funeral in the family. In the case of the Deaf and Dumb Asylum, in this city, it required several funerals before the parties could be induced to look to the sewers connected with the establishment.

The remedy we allude to is the connection of the house sewer pipes with the kitchen chimney, so that all gases that back up from the sewers will be carried up chimney and not into the house.

We have repeatedly called attention to the excellence of this remedy, have given engravings illustrative of the method of application, have cited instances of its application in other countries, have urged our architects to take special care in drawing up the specifications of new buildings to provide for these escape pipes. We now renew these reminders. Furthermore, we would respectfully ask the eminent and accomplished scientific gentleman who presides over the Board of Health in this city, whether, in his opinion, the introduction of escape pipes as suggested is not a desirable thing to accomplish, regarded from a sanitary point of view? If it is, are there any weighty reasons why the Board should not issue an order forthwith, requiring all landlords to put the pipes in? The Board, we believe, does not lack authority in the matter. It has only to speak the word, and it will be done.

THE LATEST POLAR EXPEDITION.

Dr. Augustus Petermann, the celebrated German geographer, has recently addressed a letter, on the subject of past explorations of the arctic regions, to the British Royal Geographical Society, which is of timely interest in view of the present fitting out of another English expedition to that unknown quarter of the globe. Dr. Petermann believes, from the results already arrived at, that with appropriate steam vessels, making use of the extensive experience gained, the central area will be penetrated as far as the North Pole or at any other points. He also states that the disputed question as to the proper route is clearly settled in favor of passage through Smith's Sound.

Through the individual labors of Dr. Petermann, continued since 1865, seven small expeditions have been sent out. The details of the explorations conducted have not been made public; but generally, from the interior of Greenland, in 30° W. longitude to 59° E, east of Spitsbergen, a width of about ninety degrees of longitude has been surveyed. Besides this, it is now known that the Norwegians, in frail fishing smacks, have circumnavigated Nova Zembla, and have proved that the Kara and Siberian seas are for five months in the year open. The most important information, however, communicated in Dr. Petermann's letter, lies in the extracts from reports by Captain Gray, of Peterhead. From observations made in 1868, this navigator concluded that no difficulty would be found in carrying a vessel to the Pole by taking the ice at about the latitude of 75° (where generally exists a deep bight), sometimes running in a northwest direction upwards of 100 miles toward Shannon Island, thence following the continent of Greenland as long as it is found to sound in the desired direction, and afterward pushing northwards through the loose fields of ice which will be encountered. Captain Gray penetrated northward again during the past summer as far as 79° 45'. At that latitude, in August, the ice was broken up, whereas "down to 77°," he states, "the floes were lying whole in the sea, clearly showing that the ice in 80° must have been broken up, by a swell from the north; beyond the pack to the north (which I could see over), there was a dark water sky, reaching north until lost in the distance, without a particle of ice to be seen in it."

If two thoroughly equipped steamers be despatched, one up the west coast of Greenland, by way of Smith Sound, and the other up the east coast of the same continent, there is not much question but that one or the other would ultimately reach this open water near the pole, the existence of which so many have credited. It has been the misfortune of late arctic expeditions that all have been projected on too small a scale; and although they have performed excellent service as pioneers, they lacked the completeness in organization and equipments necessary for the endurance of so long and arduous a voyage.

The preparations for the British expeditions, we understand, are already under way, and the command has been given to Captain George S. Nares, late of the Challenger. We may conclude, therefore, that the long-sought problem of reaching the pole is at length to be met by all the resources of engineering skill and scientific knowledge, in presence of which the solution cannot be far distant.

CHEAP FREIGHTS.

The American Cheap Transportation Association recently met at Richmond, Va., under the presidency of the Hon. Josiah Quincy, of Boston, Mass. Mr. F. B. Thurber read a report on railroads, in which he pointed out various abuses incident to the general management of lines in this country. Among these he mentioned watering stock, fast freight lines run by concerns outside the companies, the present palace, sleeping, and express car systems, and the fact of employees being pecuniarily interested in the use of certain materials and patents. The conclusions were that the most effectual and permanent remedy for the evils is competition, and that the most effective competition will be found in railroads when they are owned by the people. The improvement of water courses and the construction of small canals to connect large bodies of water is also necessary. An exclusive freight road, it is believed, from the grain-growing sections of the West to the seaboard, would demonstrate how cheap freight can be carried by rail; and as soon as this is ascertained, public opinion would soon compel existing roads to abolish the abuses which are absorbing the revenues of the present system.

It strikes us that any candid reader who peruses the columns of the daily journals and endeavors to master the intricacies of the strategic movements of the Pacific roads against the trunk lines, the Baltimore and Ohio against the New York Central, the Pacific Mail muddle, and the question of the Saratoga agreement, will arrive at no other conclusion but that there is plenty of competition, though the chances of cheaper freights are by no means so generally apparent. The recent completion of the Baltimore and Ohio direct road to Chicago is, it is said, destined to have considerable significance, in that negotiations are pending between its managers and those of the Erie line for a joint use, by the latter, of a portion of the former route, which would render Erie independent of Lake Shore. It appears, however, that, in spite of the pronounced benefits to be gained by the Baltimore and Ohio completion, the published rates of the New York Central are far less already than those of the first mentioned road. Mr. Vanderbilt's table of local freight tariffs, compared with that of the Baltimore road, shows rates averaging in the neighborhood of 40 per cent less for similar distances. For example: From South Branch to Baltimore, 162 miles, is charged 62 cents; from Schenectady to New York, 161 miles, the winter tariff is 50 and the summer 30 cents, all first class. Flour, per barrel, from Parkersburgh to Baltimore is $1.80, 383 miles; from Buffalo to New York, 440 miles, 50 and 70 cents.

The Central besides gives special rates to any one. A like comparison to the above shows that the tariffs on that road are actually less than those asked by the Grangers on the Illinois lines. Finally the comparison of the business done by the New York Central for the past year, as compared with 1873, exhibits an increase of 46,800 tuns in tunnage, and a decrease of $397,972.59 in earnings on freight. This looks more like practical cheap transportation than any project before the public, while it disposes of the charges of illiberality on the part of the Vanderbilt management. Mr. Thurber, in the address to which we refer in our initial paragraph, goes into facts, figures, and an elaborate argument to prove that the New York Central ought to and must charge a much higher rate of freight, because it invests its earnings and issues stock representing the same, instead of using the earnings to improve the road and carrying the balance over as surplus, after the fashion of the Baltimore and Ohio. It is unfortunate for Mr. Thurber that actual figures demonstrate exactly the reverse of his theoretic conclusions.

Eelskins dried and cut in strips make very strong belt lacings.

THE UNDERGROUND RAILWAY, NEW YORK CITY.

NUMBER VI.

Continued from page 387.

Division number two of the work commences at 79th street, ends at 102d street, and is under the charge of Mr. Sverre Lee, C.E. In this division is embraced a specimen of almost every description of construction upon the road. From 79th street to a point 27 feet 7½ inches south of the south side of 80th street, a distance of about 173 feet, is a piece of beam tunneling; from this latter point to 92d street extends a section of brick tunneling, 3,237½ feet in length; from 92d street to the north side of 94th street is the rock tunnel, 550 feet in length; from the north side of 94th street to a point 31 feet 6 inches north of the north side of 95th street is the partly rock and partly brick tunnel, 287½ feet long; from this latter point to the north side of 96th street is the tunnel known as the large tapering tunnel, whose length is 250 feet; from 96th street to the north side of 98th street, there occurs an open cut, 537½ feet in length; and finally from this point commences the stone viaduct.

Fig. 15.—THE UNDERGROUND RAILWAY IN NEW YORK.—THE GREAT ARCH NEAR 95th STREET.

We have in previous impressions described in detail sections of the beam and brick tunnel and open cut, and shall not, therefore, repeat the description in connection with similar work on this section, but merely point out in what respects, if in any, these tunnels differ from the one already described. The beam tunnel at the south end of the division is precisely similar to that on the first division. In the beam tunnel, however, which extends from south of 80th street to 92d street, several noticeable changes have been made. Thus from 80th to the center of 85th street, the roof of the large central tunnel is changed from a semi-circular to an elliptical arch, with a rise of 8 feet 10 inches, as is shown in Fig. 12, page 371. The reason for this change will be apparent by a glance at the profile of the road on page 308, which shows the difference of grades to be too small to admit of an arch of 12 feet 6 inches rise. Again, from the center of 85th street to the south side of 88th street, six rubble masonry abutments are built, so that each of the three arches rests upon two separate abutments of its own; the space between the two inside abutments, east and west (that is, between the abutment of the central arch and the inner abutment of the side arch), is filled in with dry rubble masonry up to the springing lines, and the spandrels above the springing lines with rubble cement masonry. The central arch is also elliptical. From 88th to 92d street, the tunnel is the same as that from 80th street to the center of 85th street. Omitting, for the present, the description of the rock tunnel from 92d to 94th street, we will take up that of the partly rock and partly brick tunnels.

These tunnels begin at the north side of 94th street, where the rock was not of sufficient strength and depth to allow of a rock tunnel, and consist of three brick arches supported upon four abutments of rock formed by three parallel cuttings through the rock. The two outside abutments are chipped off smooth, and lined with 16 inches of brick, carried up to the springing lines, which are 8 feet 6 inches above grade. The two inner abutments are composed of rock, carried up above the springing lines, of an average thickness of 10 feet 8 inches, and lined on the inside of the central tunnel with rubble masonry 3 feet 6 inches in thickness, and on the inside of each of the side tunnels with brickwork 1 foot 4 inches thick, thus giving to each abutment a thickness, inclusive of linings, of 15 feet 6 inches. Through each of these inner abutments are cut two man holes, 7 feet in width and 75 feet apart.

The roofs of the tunnels are semi-circular arches: that of the central arch with a rise of 12 feet 6 inches and a span of 25 feet, and that of each of the side tunnels with a span of 16 feet and rise of 8 feet, each with a uniform thickness of 2 feet. The ventilation is by means of cylindrical shafts, in general character the same as those already described, but only 6 feet in diameter in the clear, and of a depth depending on the difference of grades.

From a point 101 feet 10 inches north of the end of the rock tunnel, the two side tunnels begin to curve in gradually toward the central tunnel, which they intersect 191 feet further north. The radius of this curve is, for the center of the tracks in each of the side tunnels, 1432·7 feet, and for the center of the tunnels themselves, 1772·7 feet. From the point where this curvature starts, the inner and outer abutments are lined, each of them, with rubble masonry 3 feet thick, coursed; the courses being not less than 16 inches, and the joints cut to lay ½ inch. Owing to the curving of the side tunnels, the inner abutments are made somewhat wedge-shaped, tapering off from a thickness of 15 feet 6 inches at the point of curvature to one of 5 feet at the intersection of the three tunnels. At the end of these tunnels begins the large tapering tunnel. It consists of a brick segmental arch with a span of 68 feet in the clear, and rise of 15 feet 8 inches at the south end, and thence tapering off to a span of 50 feet in the clear and rise of 12 feet 9 inches at its north end, 165 feet further north. The springing lines of the arch are 12 feet above railroad grade, and start from the solid ledge wherever possible. Throughout its entire length, it is lined up to springing line with rubble masonry 5 feet thick. Wherever it springs from the ledge, the skewbacks consist of two courses, and abut against the ledge, hammered off to receive them.

The thickness of the arch varies at the springing line and at the crown, and these dimensions again vary with the span. Thus at the south end where the span is 68 feet and rise 15 feet 8 inches, the thickness of the arch is 4 feet 4 inches at the springing lines; a little further up the arch, it is 4 feet; still further up, 3 feet 8 inches, and at the crown, 3 feet 4 inches, thus losing 1 foot in thickness from springing line to crown. At the north end, where the span is 50 feet and the rise 12 feet 9 inches, the arch is 3 feet 4 inches in thickness at the springing line and 2 feet 4 inches at the crown. It will be observed that the arch also loses 1 foot in thickness at the skewbacks between the two ends. This is of course accomplished by a series of three offsets of 4 inches each, passing around the arch, all of which occur at the ventilating shafts. For instance, between the south end and the first ventilator, the arch at the crown is 3 feet 4 inches; from the first to the second ventilator, 3 feet; from second to third 2 feet 8 inches, and from the third to the end of the tunnel, 2 feet 4 inches. The details of this tapering tunnel will perhaps be best understood by a glance at Fig. 15, which represents a cross section of the tapering tunnel taken at the junction of the two side tunnels with the central tunnel, and shows the three tunnels in question, as also the segmental arch with its varying thickness. It will be remembered that the tunnel preceding the tapering tunnel has a total hight from railroad grade to the crown of the arch of 21 feet, and that this tapering tunnel has a total hight in the clear of 27 feet 2 inches. The manner of joining these two tunnels is illustrated in Fig. 16. The roof of the central tunnel, which has elsewhere a thickness of 2 feet, is increased to 2 feet 8 inches for a distance of 5 feet around the face, and on the back of the arch at this point is built a rubble retaining wall, 7 feet 4 inches high, 8 feet at the bottom by 1 foot at the top, which is on a level with the back of the tapering tunnel. The back of the retaining wall is lined with concrete. The joining at the face of the two small tunnels is made in a precisely analogous way.

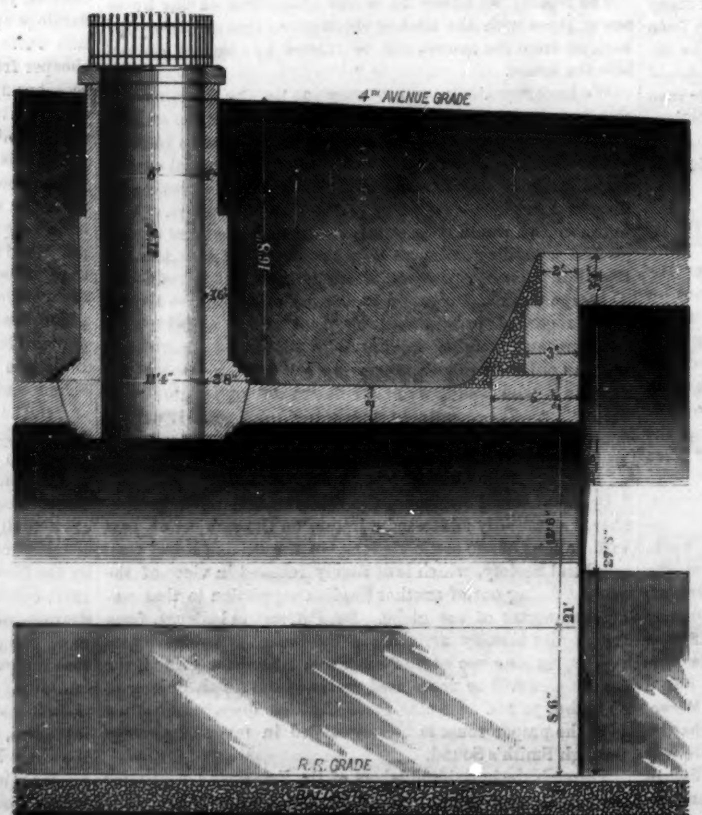


Fig. 16.—THE UNDERGROUND RAILWAY IN NEW YORK. JUNCTION OF THE TUNNELS NEAR 95th STREET.

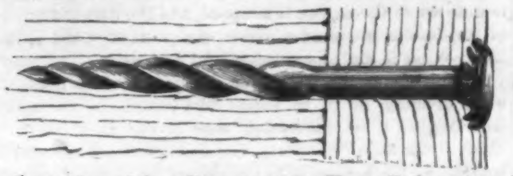
As this arch is one of unusual span, we shall take occasion in our next article to describe the centering on which it was turned.

Immense Photographs.

Photographs have been made of the new Opera House, Paris, 4 feet 3 inches in length, and 3 feet 4 inches in hight. They were obtained in one single piece, by well known processes, and with the aid of a large and specially constructed camera. All the lines of the pictures are of remarkable excellence, the moldings, the busts, the medallions, and even the minutest details being reproduced with rare perfection. The attempt is being made to secure pictures even larger than this.

A NEW NAIL.

This is a new form of nail, the peculiar features in which are its screw, shank, and the head concave underneith and provided with teeth. In using it, a hole is first bored in the wood as for an ordinary screw; the nail is then driven in by a hammer, when the teeth about the head will readily catch



in the surface of the adjacent wood. The nail thus secured can neither be turned nor withdrawn without distroying in whole or in part the fibers of the wood.

The invention will doubtless be of advantage in fastening packing cases for shipping, as, in addition to forming a strong connection, its removal, in case of any tampering with the contents, can be at once evidenced by the condition of the box.

Patented March 17, 1874, by Mr. Joseph Lowensohn of Beolin, Prussia.

CONCEPTION OF THE TELEGRAPH.

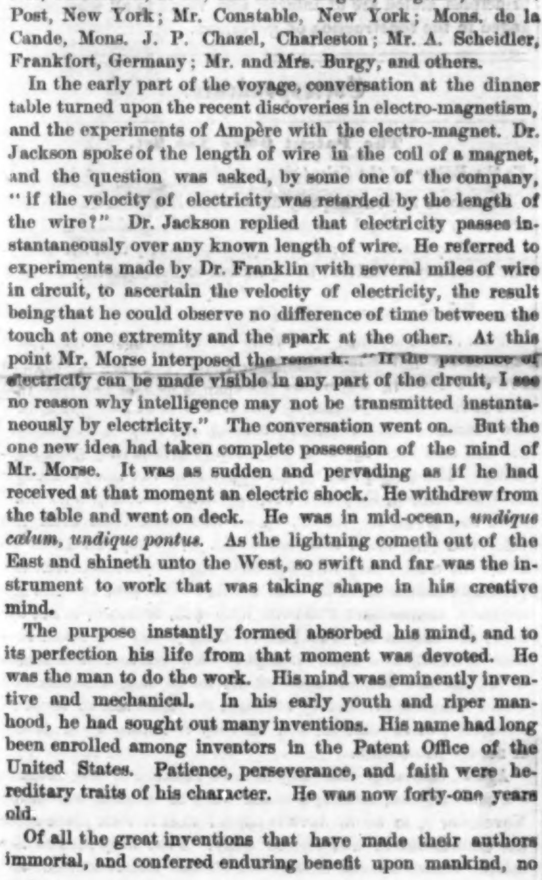
[From advance sheets of the Life of S. F. B. Morse, by S. I. Prime.]

The packet ship Sully, Captain Pell, sailed from Havre on the 1st day of October, 1832, for New York. Among the cabin passengers were the Hon. William C. Rives, of Virginia, returning with his family from Paris, where he had been as Minister of the United States; Mr. J. F. Fisher, of Philadelphia; Dr. Charles T. Jackson, of Boston; Mr. S. F. B. Morse, of New York; Mrs. T. Palmer, Miss E. Palmer, Mr. C. Palmer, Mr. F. Palmer, Mr. W. Palmer, Mr. J. Haslett, Charleston, S. C.; Mr. Lewis Rogers, Virginia; Mr. W. Post, New York; Mr. Constable, New York; Mons. de la Cande, Mons. J. P. Chazel, Charleston; Mr. A. Scheidler, Frankfort, Germany; Mr. and Mrs. Burgy, and others.

In the early part of the voyage, conversation at the dinner table turned upon the recent discoveries in electro-magnetism, and the experiments of Ampère with the electro-magnet. Dr. Jackson spoke of the length of wire in the coil of a magnet, and the question was asked, by some one of the company, "if the velocity of electricity was retarded by the length of the wire?" Dr. Jackson replied that electricity passes instantaneously over any known length of wire. He referred to experiments made by Dr. Franklin with several miles of wire in circuit, to ascertain the velocity of electricity, the result being that he could observe no difference of time between the touch at one extremity and the spark at the other. At this point Mr. Morse interposed the remark: "If the presence of electricity can be made visible in any part of the circuit, I see no reason why intelligence may not be transmitted instantaneously by electricity." The conversation went on. But the one new idea had taken complete possession of the mind of Mr. Morse. It was as sudden and pervading as if he had received at that moment an electric shock. He withdrew from the table and went on deck. He was in mid-ocean, *undique cælum, undique pontus*. As the lightning cometh out of the East and shineth unto the West, so swift and far was the instrument to work that was taking shape in his creative mind.

The purpose instantly formed absorbed his mind, and to its perfection his life from that moment was devoted. He was the man to do the work. His mind was eminently inventive and mechanical. In his early youth and riper manhood, he had sought out many inventions. His name had long been enrolled among inventors in the Patent Office of the United States. Patience, perseverance, and faith were hereditary traits of his character. He was now forty-one years old.

Of all the great inventions that have made their authors immortal, and conferred enduring benefit upon mankind, no

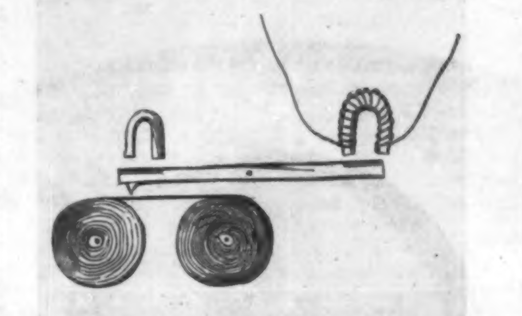


Type Signals. Tubes for Wires. Telegraph.

ORIGINAL SKETCHES FROM MORSE'S NOTE-BOOK.

one was so completely grasped at its inception as this. His little note or scratch book was always at hand, in which he made sketches of objects which met his eye, or of images formed in his mind. Scores of these books are now in existence, in which his earlier and later pencilings are preserved As he sat upon the deck after the conversation at dinner, he drew from his pocket one of these books, and began to make marks to represent letters and figures to be produced by the agency of electricity at a distance from the place of action. First, he arranged ten dots and lines so as to represent figures referring to words. Next, he drew the wires in tubes. Then came the magnets, and by and by cog rules, to be used in regulating the power. In the course of a few days his book presented several pages of the first marks ever made in the invention of the Telegraph. [All of these drawings and marks are given in facsimile in the volume.]

He wrought incessantly that day, and sleep forsook him in his berth that night. His mind was on fire. In a few days he submitted these rough drafts to Mr. Rives, who suggested various difficulties. But Mr. Morse was ready with a solution. Mr. Fisher states that Mr. Morse illustrated to him his signs for letters, to be indicated by a quick succession of strokes or shocks of the galvanic current, to be carried along upon a single wire. After several sleepless nights, while his mind was in labor with the subject, he announced it at the breakfast table, and explained the process by which he



FACSIMILE OF THE ORIGINAL SKETCH, MADE BY MORSE, OF THE ELECTRIC TELEGRAPH—TAKEN FROM HIS NOTE BOOK.

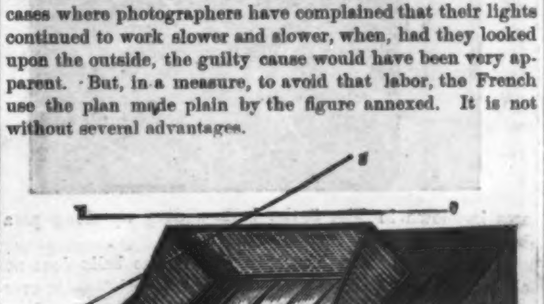
proposed to accomplish it. He then exhibited the drawing of the instrument, by which he would do the work, and so completely had he mastered all the details that five years afterward, when a model of this instrument was constructed, it was instantly recognized by Captain Pell and others, as the one he had devised and drawn in his sketch book, and exhibited to his fellow passengers on the ship.

Captain Pell says: "Before the vessel was in port, Mr. Morse addressed me in these words: 'Well, captain, should you hear of the telegraph, one of these days, as the wonder of the world, remember the discovery was made on board the good ship Sully.'"

Thus it appears from his own records, and the recollections of the captain and passengers, gentlemen of the highest respectability and intelligence, that on shipboard Mr. Morse had actually drawn out and recorded a system of signs, composed of a combination of dots and spaces, to indicate letters, figures, and words, and a mode of applying the electric or galvanic current so as to make these signs permanent upon paper, to be passed along in the instrument which he had invented. The INVENTION was accomplished and announced ere the inventor set foot on his native shore.

FRENCH PHOTO SKYLIGHTS.

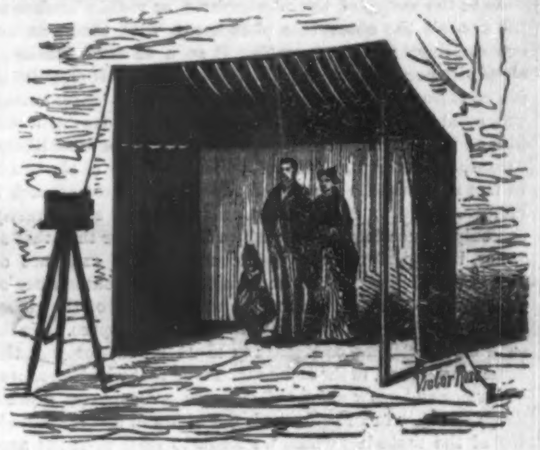
"In France they do not have as much sunshine as we; therefore," says Mr. Wilson, in the Philadelphia *Photographer*, "the construction of the skylight has had even more attention there than we give it. Every device is employed for securing a proper light, and a proper quantity of it, and for aaoiding anything that may obstruct it. We all know how many skylights are obscured by an accumulation of dirt and dust and rain on the outside. I have known of several cases where photographers have complained that their lights continued to work slower and slower, when, had they looked upon the outside, the guilty cause would have been very apparent. But, in a measure, to avoid that labor, the French use the plan made plain by the figure annexed. It is not without several advantages.



FRENCH PHOTO SKYLIGHT.

"It is similar to the ordinary construction, differing, however, in form. The sash is curved. The advantage of this arrangement is alluded to above, and to do away with the beam which absorbs the freest and is most actinic part of the light, since it strikes the sitter at precisely an angle of 45°. The other part of the roof may be sloping both ways, the proportions of the *atilier* and the glass sash remaining as ordinarily. At each end of the glass *atilier* a space may be set off of about ten feet in length on the whole width of the room, to be used as a laboratory and dressing room. The room will thus have a total length of eighteen meters, or about twenty-three feet.

For the portrait photographer who is sometimes obliged to accommodate the sitter who cannot come to his *atilier*, the



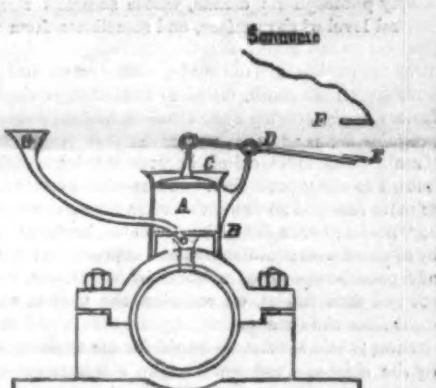
FRENCH PHOTO TENT.

annexed engraving of a tent, forming a posing room, will be found useful. The front faces the north in northern latitudes, and is turned, on the contrary, to the south in southern latitudes. Use a gray blue cloth background, which is about six feet wide by seven feet high. In travelling, it is rolled around the supporting pole; the top and the sides, forming curtains, are made of thin stuff, and held by rings to the rods of the framework, which are taken apart with great ease, to be packed into a very small compass.

In this portable *atilier*, excellent portraits may be obtained, and the time of posing is one half less than in a glass house. The professional photographer and the amateur will be henceforth able to work with advantage in the open air, and obtain very fine negatives of portraits and landscapes, with a baggage relatively light and easy of transportation.

A Hot Bearing Alarm.

This device, the diagram of which we extract from the



Revue Industrielle, consists in a cylindrical box, A, provided with a perforated bottom, B, and placed directly over the journal. The box is filled with a prepared grease which melts at a certain temperature, to which it must be raised by the shaft becoming hot. As the compound liquifies and escapes through the perforations, a disk, C, which rests thereon, descends, thereby tilting the lever, D, and so making contact between the plates, E and F. The latter are connected by an electric circuit with a bell which sounds when the current is established. The pipe, G, serves for the ordinary lubrication of the journal. It is suggested that this device might be profitably used upon journals not readily accessible.

The Shipping of the World.

The *Repertorio Generale della Marina* for 1874–75, recently published, gives some interesting statistics respecting the number of sailing ships belonging to the different nations in the world, with their tunnage. It may be remarked, however, that the following only relate to seagoing ships, vessels for inland navigation not being included:

Nationality.	No. of ships.	Tunnage.
British	20,538	5,383,763
American	6,869	2,181,659
Norwegian	4,464	1,349,138
Italian	4,343	1,227,816
French	3,780	736,326
German	3,483	852,789
Spanish	2,674	509,767
Greek	2,063	406,937
Swedish	1,905	360,368
Russian	1,498	330,350
Dutch	1,418	385,301
Danish	1,239	173,480
Austrian	955	327,742
Portuguese	410	92,808
Turkish	277	43,360
South American	219	82,761
Central American	188	46,580
Belgian	51	17,158
Asiatic	85	13,527
Total	56,289	14,383,680

The same publication gives the total tunnage of the steamships of all nations to be 5,244,888, fo which 3,015,778 tuns belong to England.

[International Review.]

THE CONSTITUTION OF THE SUN.

BY PROFESSOR C. A. YOUNG.

Number II.

THE PHOTOSPHERE.

As to the nature of the photosphere, or visible surface of the sun, all the observable phenomena, with hardly an exception, concur in representing it as a sheet of luminous cloud: its peculiar granulated structure, the swift mobility of its constituent filaments, and the remarkable appearances, presented by the spots and faculæ, are all consistent with this idea and readily explained by it. And if, as is most likely, according to what has been said, the main body of the sun is in fact a huge globe of mingled vapors and gases at such a temperature that even the enormous force of solar gravity can only reduce them to a density a little greater than that of water, it is perfectly easy to account for the existence of such a cloud sheet: it is simply a necessary consequence of the cooling of these vapors at the outer surface of the globe, where they come in contact with the cold of space. Under such circumstances condensation must result, for just the same reasons and in the same manner as that which produces the water and snow clouds of our own atmosphere: minute drops or flakes must be formed, not of water and ice indeed, but of the materials which we know to exist upon the sun, and must descend in fiery rain and hail into the central depths to be again reëvaporated. And as the descending matter is continually replaced by fresh supplies from below, there must result a vertical circulation of ascending streams and jets of vapor contesting the supremacy with down-pouring cataracts and sheets of the products of condensation; and in consequence the upper surface of the cloud layer must be in a state of continual and intense disturbance, as observation directly shows.

For it is found that the solar surface, when examined with a powerful telescope, is by no means uniformly bright, but mottled with a peculiar texture which has been very variously described, but may well enough be accounted for by supposing it to be formed of columnar clouds, floating vertically in the atmosphere of vapors out of which they are formed. Here and there the surface is marked by brilliant streaks known as the faculæ, most conspicuous near the edge of the sun's disk, which on account of the absorption of the solar atmosphere is much less brilliant than the center. They are simply photospheric clouds, whose summits rise above the general level of the surface, and sometimes form visible projections on the limb. But the most singular objects, and the most interesting, are the spots, whose origin and phenomena have as yet, we think, failed to receive any completely satisfactory explanation. They are dark blotches of exceedingly irregular form, and consist essentially of two parts, a central "umbra," as it is called, surrounded by a lighter fringe known as the "penumbra." The umbra contains usually one or more rounded spots much darker than the rest, and known as "nuclei;" even the darkest nucleus, however, is dark only by contrast with the intenser light around; for when, by means of a peculiar eyepiece, invented by Mr. Dawes, who first discovered these nuclei, we examine the umbra, excluding all light from the surrounding regions, it is found that even the darkest points are far too bright for the unprotected eye; and by the help of Professor Langley's polarizing eyepiece the color is seen to be a purple tint, closely matching that portion of the spectrum near the fixed line, H.

That the spots are hollows, having a depth varying in different cases from two to ten thousand miles, may be considered as an established fact, admitted now almost without dissent. The spectrum of the umbra of a spot is found to differ from that of the neighboring portions of the solar surface, first, in a general darkening of the whole; second, in a widening and deepening of many of the dark lines, with, on the other hand, a thinning and sometimes even an actual reversal of others; and third, in the presence of certain dark bands, sharply terminated on one edge, but shading gradually on the other. Now all these phenomena are just what might be expected in a cavity filled to a great depth by the nearly transparent gases which elsewhere form a thin layer over the sun's surface.

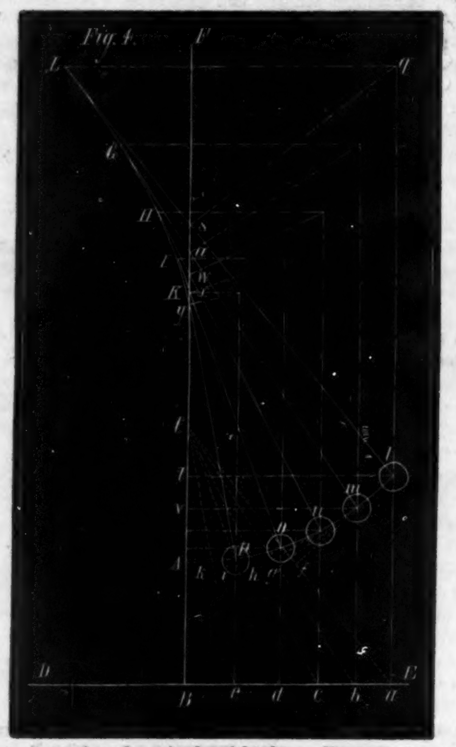
Spectroscopic observations on the chromosphere also show that around the spot there is an unusual and violent up-rush of hydrogen and other materials from the central depths.

There is a well marked periodicity in the frequency and violence of our magnetic storms and their accompanying auroras, which exactly corresponds to that of the solar spots.

PENDULUM GOVERNORS.

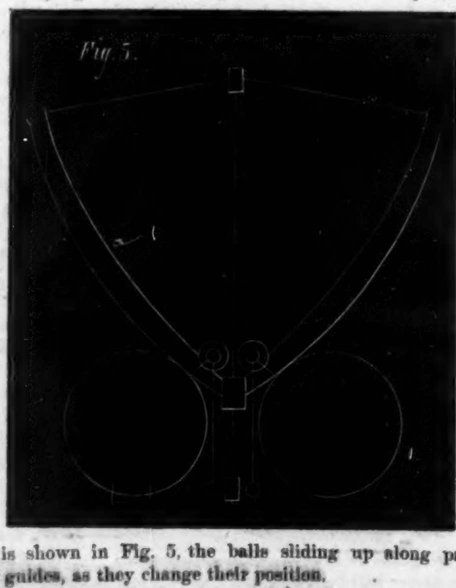
Number II.

A governor in which the hight of the balls is always the same, whatever their position, is said to be isochronous. In such a governor, the balls can only maintain the middle position, corresponding to the ordinary load on the engine, when the latter is at its proper speed, any change of speed causing the governor to act upon the regulator in such a manner as to correct the variation at once, if sufficiently powerful. In order to fulfil this condition, the centers of the balls, as they change their positions, must describe arcs of parabolas, as illustrated in Fig. 4, the curve, *l m n o p* A, being a parabola. It will be seen that, as the ball changes its position, so does the point at which the center of the ball rod cuts the center of the spindle, so that the vertical hights from center of ball to these points are always the same. In this form of parabolic governor, the end of the governor rod is made of flexible steel, and is hung to the end of a curved check, L G H I K, which is called the evolute of the parabola. The construction of the parabola and its evolute are shown in Fig. 4. The weight of balls, length of arms, and resistance to be overcome are first ascertained; and from these, the hight of the balls can be calculated when the engine is at speed. Then draw two lines, B F, D E, at right angles to each other.



Make B C equal to the calculated hights. From C, draw any number of lines, C *e*, C *d*, etc., to D E, and, at each point of intersection, erect a perpendicular to D E. From the middle point, *k*, of C *e*, draw a perpendicular to C *e*; the point, *p*, in which it meets the perpendicular through *e*, is one point of the parabola. Bisect each of the other lines, C *d*, C *c*, etc., by perpendiculars, and the points in which these perpendiculars cut the perpendiculars drawn through *d*, *c*, etc., will be other points of the parabola. From each point so determined, as from *l*, draw a line, as *l s*, parallel to the line drawn through C, to determine the given point. From each point, as *s*, in which this line cuts B F, erect a perpendicular, as *s q*, and from the point in which it cuts the perpendicular, as *a q*, through the given point of the parabola, draw a line, as L *q*, parallel to D E, till it meets the line, as *l s*, first drawn. In this way, points L, G, H, I, K, of the evolute of the parabola, are determined.

Another manner of making the balls move in parabolic



arcs is shown in Fig. 5, the balls sliding up along parabolic guides, as they change their position.

It has been shown that the weight of the balls does not affect their position, if the governor has no resistance to overcome beyond the weight of its own parts. In practice, however, a governor acts upon the controlling mechanism, and should have its balls proportioned so as to exert the requisite force. The necessary weight is thus calculated: Measure the distance of the point of suspension of each ball from its center. If there is a sliding weight, measure also the distance from its center to each point from which it is suspended. Ascertain the resistance of the controlling mechanism in pounds, and measure the length of the connections by which the governor overcomes this resistance, from their points of suspension to their points of attachment with the controlling mechanism.

1. Multiply each weight or resistance by the length of its connection, and divide by the length of the ball rod; add these quantities together, and divide them by 2.

2. Assume the greatest speed of governor that will occur under variation of load on the engine, subtract the proper speed of governor from this number, and divide by proper speed.

3. Divide the quantity obtained by the first part of the rule by the second quantity. The result will be the weight of the two governor balls.

This rule is somewhat complex, and it may be simplified by applying it to an example.

The ball rods of a governor are each 12 inches in length; there is a weight of 30 pounds connected to the spindle by a lever 9 inches in length; the resistance of the controlling mechanism is 20 pounds, and the rods connecting this mechanism with the governor are each 1½ inches long. The governor is connected with the engine so as to make 300 revolutions per minute when the engine is at speed, and the greatest number of revolutions per minute under variations of speed is to be 350. What is the proper weight for each ball?

1. Multiplying the weight on the spindle of 30 pounds by 9 and dividing by 12, we obtain 22·5 pounds as the equivalent weight, if its connection were of the same length as those of the balls. Similarly, the equivalent resistance of the controlling mechanism is 15 multiplied by 1½ and divided by 12, or 2·5 pounds. The sum of these weights is 25 pounds; and dividing by 2, we obtain 12·5.

2. The difference between the greatest number of revolutions of the governor per minute and the proper number is 50, and this, divided by 300, is 0·167, nearly.

3. Dividing 12·5 by 0·167, we obtain 74·85 + pounds, so that the weight of each ball should be about 37·5 pounds.

It will be evident, from what has preceded, that a pendulum governor which is very sensitive cannot be very powerful, nor one which is very powerful be very sensitive; and that, in order to obtain great power, it will be necessary to use very heavy balls. Our readers have, doubtless, observed that those governors which give the best satisfaction are arranged with a view to sensitiveness, the controlling mechanism being actuated by the application of a very slight force. It is probable that governors of any design will be subject to similar conditions, since a great resistance in general requires considerable force to overcome it.

We have been at great pains to simplify the rules contained in this article, and we think our readers, by applying them to a few examples, will readily understand them. The principles stated are of interest and value to all who are engaged in the construction of governors.

Correspondence.

The Patent Office Tea Set.

To the Editor of the Scientific American:

In answer to your inquiry as to what has been done in reference to the illegal presentation to Commissioner Leggett, I would say that it was stated on good authority that the Assistant Secretary submitted the question to the Attorney General for his opinion, and that it was finally concluded to drop the matter, and do nothing about it.

That it was a plain, open violation of the law is clear, and is admitted by the more honest of those who participated in it. The leading ones—those who headed the subscription and gave the most, some of whom are soon to come before the Senate for confirmation—fearing the effect of their illegal act, now seek to evade it by denying that they gave anything. The ground on which they do this is that, although they subscribed, they did not pay their subscriptions until after the 1st of November, which was some time after the plate was purchased and presented. Possibly, in order to avoid the effect, they may not have paid it yet; but that the present Commissioner headed the list with $50, and the Assistant Commissioner followed with $25, or more, is not denied, and cannot be, truthfully. This, to say the least, is a most cowardly and mean attempt to crawl out and leave blame to fall on the subordinates, nearly all of whom subscribed under compulsion: merely to retain the goodwill of those in authority, or to come in, and thereby to retain their places or secure promotion.

Again, they urge that they did not violate the law, because the subscription, although made early in October, was dated November 1, so as to have it appear that it took place after the Commissioner was out of office. This only makes the matter worse, because it shows on its face a knowledge of the law, and a deliberate attempt to evade its plain provisions.

Again: they urge that it was at best but a technical violation, because, although legally Leggett's resignation did not take effect until the 1st of November, still practically he was already out of office. The trouble with this is that it is not true, for not only did he remain until after the presentation (October 19, I think it was), but the Office records show that he acted as Commissioner and made decisions after that—at least so I am informed and believe. It has also been stated that this matter of the presentation originated with the lady employees. This is not true, and it is all the more unmanly for these parties to seek to shift the responsibility from their own shoulders to those of the women. A certain woman did originate, or at least carry out, the plan of presenting the cane; but the tea set presentation originated with, and was carried out by, the male employees. A certain examiner, who hoped and expected to be made Assistant Commissioner, was the main mover in the matter, and personally circulated the subscription paper.

Not only was the whole proceeding a palpable and wilful violation of the law, but they were so told at the time, by some who refused to subscribe, for that among other reasons. The whole matter, both in the transaction itself and in the neglect to enforce the penalty of the law by the Secretary, is but a fair illustration of the contempt for the law manifested of late by the Patent Office officials. JAMES.

GREAT BRITAIN has formally accepted the invitation of the United States to contribute to the Centennial.

THERE is no mode so effectual to impress ideas on the mind as that of experiment aided by reflection.

PRACTICAL MECHANISM.

NUMBER XIV.

BY JOSHUA ROSE.

In the experiment referred to in our last, the valve had (in the first instance, when it had no lap) one sixteenth inch of lead so as to give that amount of exhaust opening when the piston was at the end of the stroke. In the second instance, however, when the valve had $\frac{5}{16}$ of steam lap added to it, it was set so as to have not more than $\frac{1}{64}$ of lead, the author being convinced that, when a valve has sufficient lap to give a moderately free exhaust, there is more to be lost by back pressure from excessive lead than to be gained by the small amount of assistance it lends towards making the exhaust more free. If a valve has no lap at all, it may with advantage be given an amount of lead that would otherwise be decidedly detrimental. It would appear that, in the early days of steam engineering, one of the advantages due to adding lap to the valve (a free exhaust) was largely attributed to the lead of the valve, since sufficient lap to cut off the steam supply when the piston has traveled three quarters or even more of its stroke will give a sufficiently free exhaust, even supposing that the valve has no lead at all.

Referring again to the advantage in economy due to using (or, as it is commonly called, working) the steam expansively, it is self-evident that, if we have steam at a gage pressure of 50 lbs. per inch, (that is, above the pressure of the atmosphere) and permit its escape at any pressure above that of the atmosphere, we shall not have extracted from it all the power it contains, because it may be used at the initial pressure of 50 lbs. per inch during a certain portion of the stroke, and, by then being permitted to expand itself before being exhausted, may be employed to perform duty as steam of 49, 48, 47, etc. lbs. per inch, and so on down to that point at which the indicating needle or hand of the steam gage will stand at zero, denoting that there is no longer any pressure in the steam. This last, however, is not actually the case, since the pressures marked on the gage are in each case 15 lbs. per inch less than the actual pressure of the steam when the needle stands at that point, which 15 lbs. serves in a high pressure engine to overcome the atmospheric pressure: which, in consequence of the exhaust port being open to the atmosphere, acts upon the exhaust side of the piston as back pressure, and therefore has to be overcome by an equal pressure of steam on the opposite side of the piston; so that, when a high pressure engine uses its steam expansively, so that it exhausts at the gage pressure of zero, it has extracted from the steam all the useful effect possible in such an engine, but at the same time not all the useful effect or power which the steam contains, as will be hereafter explained. This leads us naturally to another consideration, which is that, if steam be used expansively in a high pressure engine to an excessive extent, the result is an actual loss of power, because, if the steam on the one side of the piston is at a pressure less than the atmospheric pressure on the other, the latter acts of course as a retarding force to the advancing piston.

The steam passages between the valve seat and the cylinder bore, and the clearance between the piston (when it is at the end of its stroke) and the cylinder cover, are spaces which have each to be filled, during each revolution of the engine, with live steam; and if the engine is not worked expansively, this live steam escapes without giving any of its power to the engine, and is lost, except in so far as it was necessary to fill those spaces. If, however, the engine is worked expansively, the expansive force of such live steam is extracted from it and applied as useful effect upon the piston, the result being an appreciable gain in the economy of steam, especially in those engines which, by reason of having the valve seat in the center of the cylinder, have very long steam passages, not merely because of the length of such passages, but also because in such cases the steam port serves alternately as the exhaust port, and has therefore to be made of larger proportions than it would need to be if employed as a steam port only, since an exhaust port always requires to have a larger area than a steam port. Hence the content of such passages, together with the clearance before referred to, bears a large proportion to the whole contents of the cylinder; and to extract power from the steam contained in them, by utilizing its expansive force, is a considerable gain to the engine.

From what has been already said, it will be perceived that a high pressure engine, to work to the greatest possible advantage and economy, should work its steam expansively to such a degree that it will be exhausted at zero of the pressure gage, or in other words at a pressure of 15 lbs. per inch, that being equal to the pressure of the atmosphere on the exhaust side of the piston. The point in the stroke at which it may be necessary to cut off the supply of steam to the cylinder, in order to effect such an amount of expansion, will vary according to the pressure of the initial steam and the length of the stroke of the engine, and must hence be determined according to those conditions.

An approximate calculation, as to what extent the steam in a cylinder is working expansively and its pressure at the termination of each inch of piston stroke, may be made by making the whole distance the piston has moved (under both live and expansive steam) the denominator and the distance it has moved under expansive steam the numerator of a fraction, and then multiplying the initial pressure by the numerator and dividing by the denominator of the fraction; then subtract the quotient from the initial pressure, the last product being the pressure of the steam. Thus: Supposing the initial pressure of the steam admitted to a cylinder to be 60 lbs. per square inch, the length of the piston stroke to be 20 inches, and the supply of steam to the cylinder to be cut off by the valve when the piston has traveled 5 inches of its stroke, what pressure of steam will there be in the cylinder when the piston is at the end of the tenth and twentieth inches of its stroke, respectively: Here the tenth inch of stroke—whole distance moved by the piston $=10$, distance moved by the piston under-expansive steam $=5$, hence the fraction $\frac{5}{10}$; then the initial pressure $60 \times 5 = 300 \div 10 = 30$; then $60 - 30 = 30 =$ the lbs. pressure on the piston when it had arrived at the end of the tenth inch of its stroke.

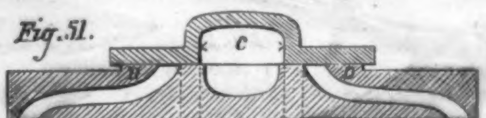
Again: Whole distance moved by piston $=20$ inches, distance moved by the piston under expansive steam 15 inches, hence the fraction $\frac{15}{20}$; then the initial pressure of the steam $60 \times 15 = 900 \div 20 = 45$; then initial pressure $60 - 45 = 15 =$ the pressure of the steam in pounds per inch at the end of the twentieth inch of the stroke or piston movement.

By making such a calculation for every inch of the piston movement and setting the figures in a column and adding them together, and dividing their sum total by the number of inches in the stroke, we arrive at a tolerably accurate estimate of the average pressure of the steam upon the piston throughout the stroke.

A review of the above calculations discloses that, as before stated, the pressure of the steam has decreased in precise ratio to the increase of the space it occupied, that is to say, when the piston was at the end of its fifth inch of stroke (the steam supply being cut off) there was five inches of the length of the cylinder filled with steam at a pressure of 60 lbs. per inch; and when the piston was at the tenth inch of its stroke and the steam had expanded so as to occupy ten inches of the length of the cylinder, the pressure was reduced to 30 lbs. per inch; and the same rule applies to the twentieth inch of stroke, for the steam then occupied four times the space it did as live steam, and had therefore fallen to one fourth of its original or initial pressure. It is to be noted, however, that while such a calculation is absolutely correct as applied to any one definite point of the stroke (making no allowance for the steam in passages and clearance) it is not entirely correct in its results if we take a number of such points to obtain therefrom the actual average pressure of steam throughout the stroke, for the following reason: Suppose we calculate (by the given rule) the pressure of the steam per inch upon the piston when it had concluded its sixth inch of stroke. Here the whole distance moved by piston $=6$ inches, distance moved under expansion $=1$ inch, therefore the fraction is $\frac{1}{6}$; then the initial pressure $=60 \times 1 = 60 \div 6 = 10$, then again initial pressure $60 - 10 = 50 =$ pressure of steam per inch upon the piston at the termination of its sixth inch of stroke. Now while 50 lbs. per inch accurately represents the pressure of steam upon the piston at the termination of its sixth inch of movement, it in nowise represents the average pressure of steam per inch during the whole inch of movement, because the piston commenced that inch of its movement or stroke under 60 lbs. pressure of steam per inch, and not until it had concluded that inch of movement was the pressure reduced to 50 lbs. per inch. Nor will it avail us to take the mean between the two, that is 55 lbs. per inch, as the average pressure for that inch of movement; because, so long as we calculate the pressure at every inch of the stroke, we shall have the same discrepancy between the pressure at the beginning and at the end of the inch of movement, whether it be at the fifth, sixth, or seventh inch, or at $5\frac{1}{4}$, $6\frac{1}{4}$, or $7\frac{1}{4}$ inches of the stroke. To get a more nearly correct result, we must take a greater number of points in the stroke such as every half or quarter inch of the piston movement; the more points taken, the more nearly correct will be the result obtained. It is, however, generally considered as sufficiently correct for practical purposes to take as many points as there are inches in the piston stroke.

With a common slide valve, it is not practicable to cut off the steam supply to the cylinder sufficiently early in the stroke to effect so large a degree of expansion; because, in the first place, it would require the valve to have an excessive amount of steam lap, and the exhaust would take place too early in the stroke, thus causing the piston to travel a large proportion of the latter part of the stroke without having any pressure of steam behind it; and because in the second place, when there is the large amount of steam lap on the valve necessary to cut off earlier in the stroke than at two thirds (that is, carrying full steam two thirds of the stroke) the admission, expansion, and exhaust of the steam to, in, and from the cylinder becomes very irregular in the forward as compared to the backward stroke of the engine, which irregularity will be shown and treated upon in connection with the piston movement, steam supply, etc. To obviate the defect (above referred to) of a too early exhaust, the valve may have lap added to its exhaust side, that is to say, the exhaust port of the valve may be made narrower than the width between the two nearest together edges of the steam ports of the cylinder face, as shown in Fig. 51, C being the exhaust

Fig. 51.



port of the valve and from A to B being the lap on the exhaust side. Such lap is, however, only possible when there is a good deal of lap on the steam side of the valve.

The amount of exhaust lap is at all times to be governed by the speed at which the engine is to run. A fast running engine, cutting off its steam supply at about one half stroke (which is the extreme limit of expansion permissible with a slide valve), may have exhaust lap to half the amount of the steam lap; a slow running engine may have exhaust lap to nearly three quarters of the amount of the steam lap. The reason of the difference is that, as the exhaust lap retains the steam in the cylinder longer, it, to that extent, cramps the exhaust; and as a quick running engine requires a more free exhaust than a slow running one, the latter may have its exhaust more covered by the exhaust lap when the piston is at the end of its stroke.

The objection to a valve having clearance is the open communication permitted between the steam and exhaust ports, which, though it exists for only a comparatively insignificant space of time, is a radical defect, especially when it is borne in mind that, as we have already shown, a slide valve should always have steam lap, and therefore will always have a proportionate amount of exhaust opening, in addition to that given to it by the lead of the valve. Clearance, then, is an expedient which should never be resorted to, it being a blunder applied merely to remedy a blunder. Clearance to a valve having much lap on its steam side is altogether inadmissible, since it is not requisite to give a more free exhaust, while it assists in letting the exhaust steam escape earlier in the stroke; and by this means, it adds to a defect inherent in slide valves having much steam lap, which is a too early exhaust.

A slide valve is sometimes given what is called clearance, that is to say, it is made wider in its exhaust port than are the two nearest together edges of the steam ports, so that (referring to Fig. 51) the port, C, of the valve would overlap the steam ports to the amount of the clearance, giving to them both an open communication with the port, C, and therefore with each other during the instant of time at which the valve is in the center of its travel. Clearance on the exhaust side is therefore the very opposite of lap on the exhaust side of a valve. The object of clearance is to give the valve a more free exhaust, and it is therefore only resorted to in cases where, the valve having little or no steam lap, the exhaust steam cannot freely escape.

Common slide valves, however, work to better advantage when the lap is so proportioned as to cut off the steam at from two thirds to three quarters of the stroke than at any other point, because of the comparatively long stroke of the valve (and hence large eccentric) necessary when much steam lap is brought into requisition, and because of the large amount of friction between the valve and cylinder faces in consequence of the pressure of the steam on the back of the valve. There are of course many devices for balancing such valves and some for reducing the pressure to a minimum, but none have as yet appeared whose benefits have proved such as to cause their general adoption for locomotives or small stationary engines, to which the application of the common slide valve is now almost universally confined.

To reduce the friction to a minimum, that part of the cylinder face upon which the face of the slide valve works may be raised above the general face upon which the steam chest beds, as is shown in Fig. 51, so that the steam lap of the valve may have the steam on the under as well as the outer side, and be to that extent relieved of the outer pressure. In such case, the width of the projecting faces (marked D in Fig. 51) should not be any wider than is the bridge (of the cylinder face) between the steam and exhaust ports; otherwise the wear of the face of the bridge will be the greatest and the valve seat of the cylinder face will wear hollow, the valve springing (to fit such face) from the steam pressure on its back. Especially is this the case where a high pressure of steam is employed. It is not uncommon to cut away these faces, leaving them full only around the edges of the ports, which cutting is performed by a slotting drill.

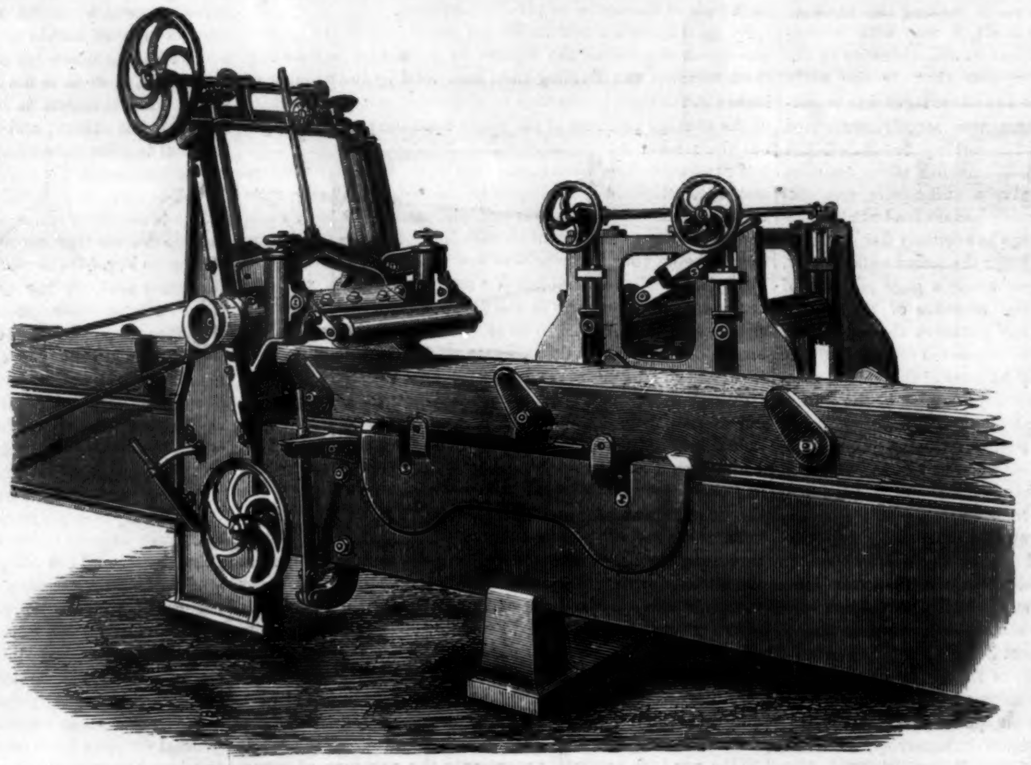
It is advantageous to make the steam ports long and narrow rather than short and wide, so that, when the valve commences to open, whether it be on the steam or exhaust side, a small amount of opening will present a comparatively large area for the ingress or egress, as the case may be, of the steam; hence the supply and exhaust of the steam to the cylinder will be larger in proportion to the valve movement, and therefore more instantaneous. A long port will of course entail a broader valve surface, and hence increased pressure of the valve to its seat; but this is compensated for by the decrease in the stroke of the valve (and hence in the diameter and stroke of the eccentric) permissible with the long port.

The rule sometimes given by which to calculate the required area of a steam port is, say, for a fast running engine: One eighth the area of the piston is the proper area of the steam port; the employment of such a rule, however, gives a result bearing no definite relation to the piston speed, and leaves a wide margin of difference, since either 300 or 600 feet of piston travel per minute is a fast running engine; whereas the amount of steam required to pass through the port for the one speed (supposing both pistons to be of equal diameter) is double that required for the other; while if the port area is larger than necessary, it causes a serious loss of steam; whereas if it is too small, it wiredraws the steam and fails to supply steam at full pressure to the cylinder. The following rule, given by Mr. Bourne, appears to meet the exigencies of the case, by giving the port an area proportionate to the quantity of steam required to pass through it. The rule is; Multiply the area of the cylinder in square inches by the speed of the piston in feet per minute, and divide the product by 4,000; the quotient is the area of each steam port in square inches.

EVERY subscriber of the SCIENTIFIC AMERICAN ought to be an agent for the increase of its circulation. Whoever reads the paper can aid in this matter very materially by recommending it to his neighbors. In the absence of agents, we appeal to our friends to lend us a hand. Let us have a "subscription bee," such as we remember in our early days, when all turned out, with oxen, horses, plows, and shovels, to do up some good work with dispatch.

TRYING-UP AND FOUR-CUTTER PLANING AND MOLDING MACHINE.

We illustrate herewith a new wood planing and molding machine introduced by Messrs. Wm. Furness & Co., of Liverpool, Eng., for the combined purposes of dimension planing, or trying-up, and planing on all four sides timber of any length, and up to a given width and thickness. The machine is shown adapted for trying-up or planing perfectly level and out of wind a piece or pieces of timber up to 20 feet long, 20 inches wide, and 16 inches thick. This is done in the ordinary way by revolving horizontal cutters, driven by two bands, one on each side of the machine, the table with the timber traveling under the cutters at the desired rates of feed, a quick return motion being provided for bringing back the table. The novel part of the machine consists in the feed works, which are here shown to be behind the table. These feed works are formed of four calender rollers powerfully geared, between which works the bottom cutter head driven from a countershaft fixed to the framing of the machine. The side cutter heads are in advance of the second pair of feed rollers, and are also part of the feed works. One side cutter head is a fixture, and the other is worked in or out on slides by means of a screw. It will thus be seen that the feed works comprise the feed rollers and necessary driving gear, bottom and side cutter heads, and pressure rollers, etc. The whole is carried by four grooved friction rollers, running on two turned rods supported by the framework of the machine and a bracket at the back.



TRYING-UP AND FOUR-CUTTER PLANING AND MOLDING MACHINE.

When it is desired to use the feed works for tonguing and grooving, molding, or planing all four sides of the timber at once (says *The Engineer*, from which we select the engraving), the table of the machine is run forward till the end is almost under the top cutter head, when the feed works can be easily drawn across the framework of the machine. It fixes itself in V slides; and the bands for bottom and side cutter heads having been placed on their respective pulleys—which are fixed on the ends of the spindles, so that no lacing or fastening is required—the machine is ready for work. It will work any size of timber up to 4 inches thick and 12 inches wide. By the removal of the side cutter heads, which is a very simple operation, surfacing or panel planing can be done by the top cutter head alone up to 20 inches wide. A very important feature of the machine is the rapidity with which the feed works can be removed when the machine is required for trying-up purposes, about five minutes being required. A great advantage, and worthy of attention, in this combination of two efficient machines is that they only occupy the same space as one machine, and only require one pulley upon the shaft of the mill to drive them.

NEW MECHANICAL CONSTRUCTION FOR COMPOUND TOOLS.

We have lately had brought to our notice an entirely novel construction for scissors, pliers, shears, and other tools of similar nature, which is an invention of considerable utility and merit, and which will doubtless commend itself as a valuable addition to the kit of every mechanic. In using implements with pivoted jaws, a large percentage of the power is wasted in useless strain on the pivot. In the present device, the pivot is abolished, and the jaws are so arranged as to be forced together by a powerful cam lever. To add to the utility of the tool, these jaws are made interchangeable, so that a single stock may answer for saw gummers, pliers, shears, saw set, pincers, and a multiplicity of other implements.

Referring to the engraving, Fig. 1, A is the stock, B B' the handles, C C' the operating jaws, and D, a spring for opening the latter. The stock is recessed to form two side pieces, between which the shanks of the jaws are pivoted at *c* and *b*. The upper jaw, C', Fig. 4, has a long shank which is recessed near its head to receive the cam, B', which is formed on the handle, B'. The end of the shank of the under jaw, C, which is pivoted, as stated, at *c*, impinges against the shank of the upper jaw. The cam lever handle, B', is pivoted at *a*.

When the handle, B', is brought toward the stock handle, the cam on the former presses against the shank of the upper jaw. From this last, motion is communicated to the under jaw, so that each is made to approach the other. By reversing the handle, B', a more powerful leverage may be brought to bear on the jaws. The cutting edges are thus forced together square and true, not overlapping so as to tear the material apart, as is frequently the case in pivoted cutting tools. There is therefore less strain on the jaws, and they are consequently more durable. A recess is provided through the jaw, C, through which bolts or wires to be cut may extend, so that a bar of any length may be divided squarely at any desired point. Each jaw is tempered separately, thereby giving to both an improved temper, unattainable in the ordinarily constructed implement. Finally, the jaws are easily adjustable, so that in case of injury they may be readily removed and others substituted, or, as above stated, tools for a different purpose may be inserted.

We are informed that, since the date of the patent of the invention, by Peter Broadbooks, of Batavia, N. Y., November 18, 1873, important adaptations of the system have been made, so as to render it suitable for the tools of over fifty classes of mechanics, including, among others, tongs, presses, bolt cutters, pruning shears, punches, pipe wrenches, and horse shoe nail clinchers. The construction of the implement last mentioned is shown in Fig. 2. The arrangement of parts is the same as in Fig. 1, except that the jaws are shaped differently and are provided with serrated faces. The jaw operated by the cam lever goes under the hoof, and the angle of the latter enters the curved portion between the jaws. The corrugated face of the upper jaw, therefore, takes against the incline of the hoof, and, as it is rubbed down the same by forcing the handles together, the corrugations catch against and clinch the nails. This is done quickly and without injury to the hoof, thus saving to the animal a large amount of the suffering often caused by the usual mode of clinching.

We have tested various sizes of pliers constructed after the plan described, and find that they cut nails and spikes with great facility, one little instrument, no larger than a conductor's punch, biting off shingle nails as easily as if they were pins. The device is excellently suited for saw gummers.

BROADBOOKS' COMPOUND TOOL.

The adaptation of the invention as a hand vise is shown in Fig. 3, and as a shears, in Fig. 4.

Further particulars and descriptive circulars may be obtained by addressing Messrs. S. P. Allen & Co., care of Pollock, Weaver & Co., 17 West Main street, Rochester, N. Y.

New Discoveries in the Mammoth Cave.

Professor F. W. Putnam, of the Peabody Academy of Sciences, Salem, Mass., has recently explored the Mammoth Cave in Kentucky, and has visited several caverns never before entered. His investigations have resulted in finding colored fish without eyes, thus exploding the theory hitherto held that all eyeless fish are colorless. White fish with eyes, and crayfish both with and without those organs, were obtained, presenting many new features of great interest to naturalists. Skeletons of human beings, mounds, and a large variety of valuable archæological relics were found in the new chambers.

Cheap Telegraphy.

President Orton's report of the affairs of the Western Union Telegraph Company is not calculated to inspire much hope in those who believe that the government can run the lines at cheaper rates to the public. On the 1st of January, 1873, a reduction of more than fifty per cent was made in the maximum tariff between the most remote points on the company's lines. This, though occasioning a temporary loss of revenue, has resulted, during the last few months, in a large increase. The reduction was from $7.50 and $5 to $2.50. President Orton now adds that, owing to Messrs. Edison's and Prescott's quadruplex apparatus, which is, at the present time, working successfully between Chicago and New York, and by which two messages are sent in the same direction and two more in the opposite direction simultaneously on a single wire, he believes it practicable before long to cut rates down still lower, and ultimately to establish but four rates for day messages, namely, twenty-five, fifty, seventy-five cents, and one dollar, with half charges (except for the lowest) for night messages.

Decline of City Trades' Unions.

The repeated strikes, and the suffering caused thereby to the workmen participating, are at last beginning to open the eyes of the latter to the evils of trade union rule. It appears that the unions in this city since 1873, taken as a whole, have lost fully one fifth of their members—aggregating 9,000 men. As a rule, these people have found employment, and doubtless now perceive the advantage of steady work, even at lower wages, over starving in idleness in the hope of getting ultimately a few dollars more. Some societies have suffered in a remarkable degree, notably the painters and coopers, which have lost respectively fifty and forty per cent of their members. The building trades show a decline of twenty-five per cent; the shoemakers, twenty per cent, and the cigar makers, thirty per cent. The horseshoers, tailors, hatters and 'longshoremen maintain their strength, though the numbers of the latter bid fair to be much depleted through the recent difficulties with the shipowners.

The Highest Lake in the United States.

Dr. Harkness has discovered, in Plumas county, California, a body of water, probably the most elevated in the United States, the barometer registering a hight of 7,330 feet above the sea level.

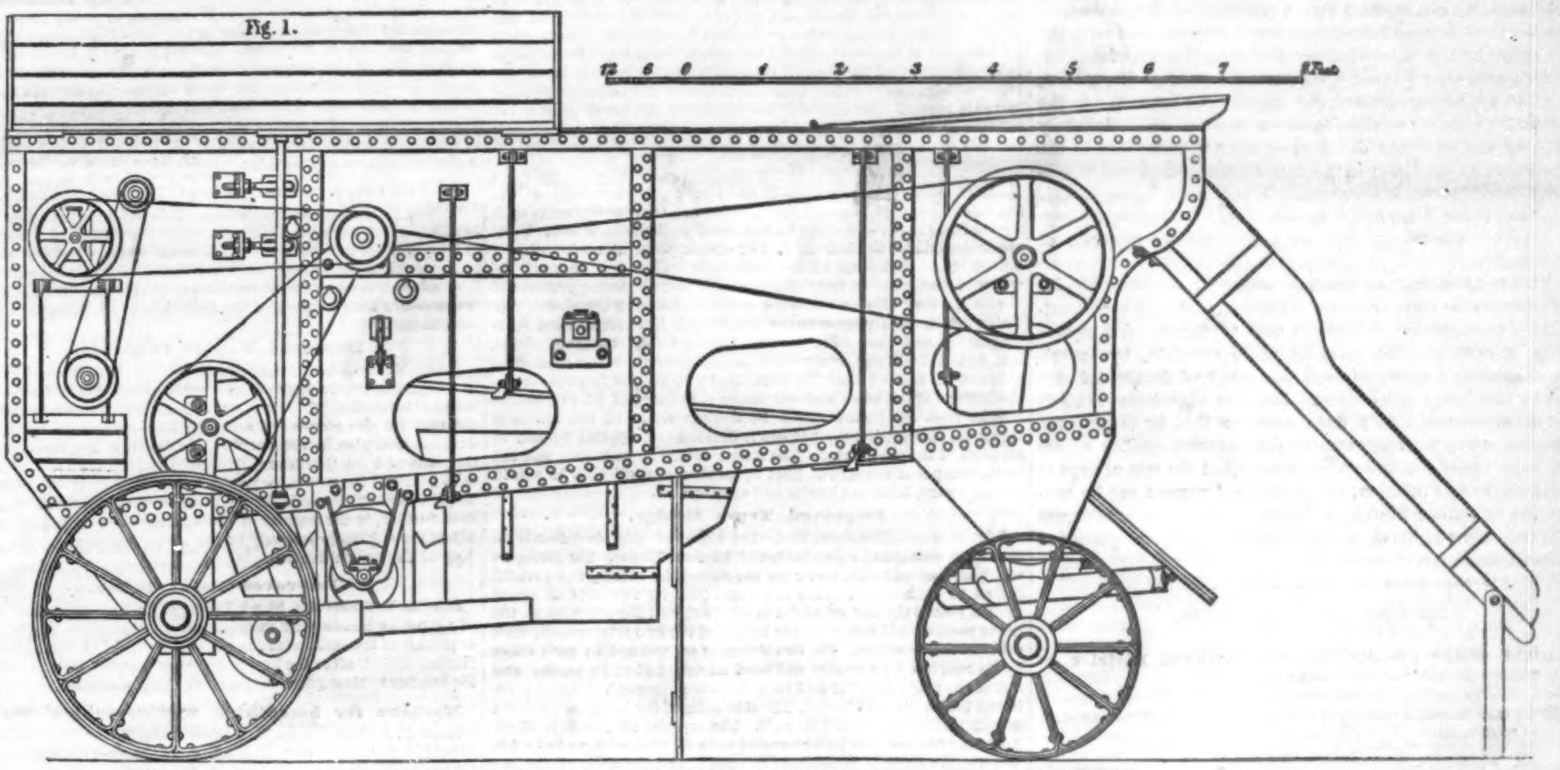
The lake is of triangular shape, having its longest diameter about one mile and three quarters in length. The water during last August was intensely cold and of a deep blue color. The outlet is into Warner Valley, over a declivity of some 2,000 feet. The California Academy of Sciences has named the lake, after its discoverer, Lake Harkness.

Ignorance and Crime.

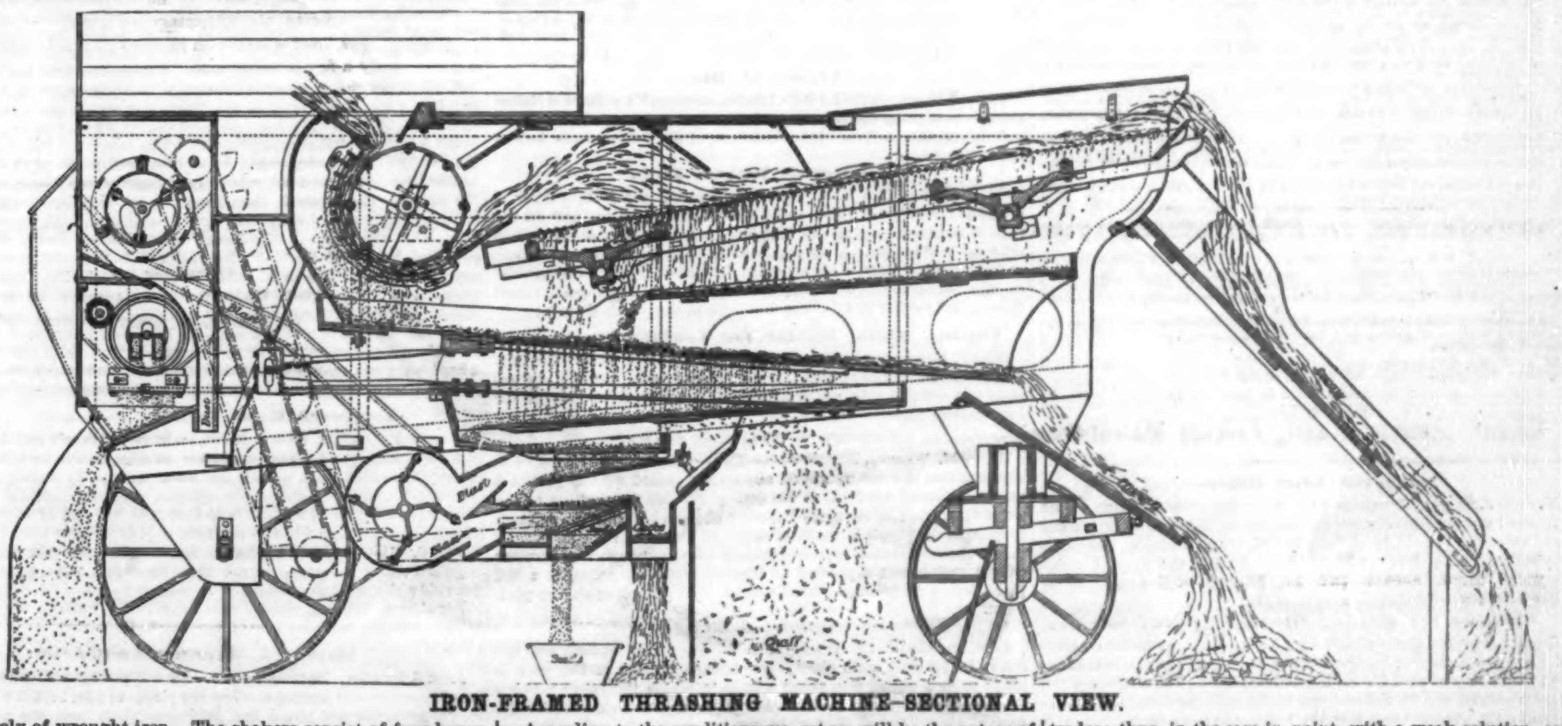
We doubt if more striking evidence of the necessity of compulsory education laws and the provision of means for their rigid enforcement could be found than appears in a suggestive fact in the pages of a recent report of the National Prison Association. This volume, which is filled with copious statistics of prisons and convicts in this country, deals incidentally with the causes of crime, making its deductions from the various prison reports of the mental and social condition of the incarcerated. Ignorance is proved to be the worst evil with which a community must struggle. Forty-eight per cent of all the convicts in the United States can neither read nor write, and only one per cent of the aggregate have acquired a superior education. We trust that the enforcement of the compulsory laws already enacted in some of the States, will soon justify the wisdom that prompted them, and lead to an improvement in the average education of the lower classes.

IRON-FRAMED THRASHING MACHINES.

We illustrate herewith an iron-framed thrashing machine, the manufacture of which has been made a specialty by Messrs. Marshall, Sons & Co., of Gainsborough, England, who have turned out, according to *Engineering*, a large number of these machines. Fig. 1 is a side elevation, which shows the framing, stiffened around the edges, and at intervals in the length by plates. It also shows the arrangement of the pulleys for driving the drum, shakers, fan, etc. The other view is of a longitudinal section through the center of the machine, and shows clearly the arrangement of drum, shakers, shoes, barley awners, and fan. The engravings explain the arrangement of the machine thoroughly, and we need not, therefore, attempt any detailed description, but confine ourselves to the special features of this machine, other than the iron framework mentioned above. The drum spindle is of steel, and the rings placed upon it are slotted out, as shown in our second engraving, to receive a number of iron bars, to which the beater plates are attached, this arrangement being found preferable to introducing wood beneath the beaters. The concave at the back of the drum is entirely of wrought iron. The shakers consist of four boxes, the straw platforms being arranged as shown. They are actuated by two crankshafts, one at each end, connected with the shakers by brackets. The cranks are provided with long bearings, and a collar at each end, over which the top bearing block overlaps, to keep out the dirt. The reciprocating dressing shoes are hung on spring rods, as shown, and are worked by a crankshaft similar to those for the shakers. The whole of the blast employed in the machine is taken from one fan, shown in the second engraving, one part being taken under the riddle of the main dressing shoe, and the other thrown upwards to act on the corn as it passes from the cleaner to the screen. The elevators are entirely within the machine, and lift the grain from the reservoir. We may add that a thrashing machine of this type was exhibited by Messrs. Marshall & Co., at Vienna. And we would also state that manufacturers of agricultural machines in this country would do well to take the hint from the English builders and use more metal in the construction of frames for thrashing and similar machines.



MARSHALL & CO.'S IRON-FRAMED THRASHING MACHINE.



IRON-FRAMED THRASHING MACHINE—SECTIONAL VIEW.

[The Telegraphic Journal.]

ELECTRO-DEPOSITION OF METALS.

BY J. T. SPRAGUE.

[Concluded from page 390.]

The connecting wires should be secured to the objects while under water, unless, which is much better, they can be soldered on before cleaning; it is usually better to have two or three wires to an object, so as to diminish the resistance, and to shift the points of contact occasionally, in order to avoid furrows upon the face; it is better also to make the actual contact by short pieces of fine wire attached to a larger conductor not in contact with the object. The general principle to be kept in view is to make the resistance of these connecting arrangements as small as possible, and yet to avoid anything which shall interfere with the contact of the liquid and its free circulation over every part of the surface to be coated.

According to the conditions we set up will be the nature of the metal deposited: that is to say, its molecular condition as to cohesion, etc., will depend upon the relations of force to which the deposit is exposed. Color also depends, in great degree, upon the molecular condition of the surface; for instance, gold in very thin films has a greenish tint, owing to the light reflected through it; in a very finely divided state, as when chemically precipitated, it is a dark brown; in its ordinary condition, also, the presence of very small quantities of copper and silver greatly modifies the color. To secure deposits of good quality and appearance, therefore, it is desirable to ascertain those relations of energy which set up the conditions upon which good deposit depends.

If we pass a strong current into a weak solution of copper, the metal deposited will be pulverulent; if, by means of resistances and varying battery power, we pass a fixed current into a solution, but effect the deposit upon a surface of gradually diminished area, a series of instructive results will be obtained. If the surface is very large in proportion to the current, the deposit will form in separate crystaline granules, chiefly on the edges and corners, and a deposit formed under these circumstances will develop into a series of nodules capable of easy separation from each other. If the surface is small compared to the current, the deposit will be of a brown color, and have no coherence; this state, also, will begin to show itself first at edges and corners; there the deposit may be quite friable, while a good metal is forming at the middle of the plate. The principles of liquid conduction account for these effects by showing that the current acts in a higher degree at points and edges, just as charge does in static electricity, because at these there can be set up the most numerous lines of polarisation towards the opposing surface. We learn, in fact, that there are two sets of conditions to be attended to.

The first point is the strength of solution. If we pass a strong current in a weak solution we get the brown powder; if, without altering any other condition, we add saturated solution of the metal, the deposit may become good. In every solution there are several different ions present at the electrodes; thus, in the case in point, with a weak solution, only a small part of the cathode can have copper turned towards it; by far the greater portion of its surface must be in contact with the hydrogen of the water or acid; the conditions are, in fact:

$$\text{Cathode}\left\{\begin{array}{ll} CuSO_4 & H_2SO_4 \\ H_2SO_4 & H_2O \\ H_2O & CuSO_4 \\ H_2O & H_2SO_4. \end{array}\right.$$

Now, if the current (or quantity) is larger than the Cu is equivalent to, of course H_2 is set free, and this will reduce a neighboring atom of copper, but not in contact with the electrode; that is to say, the deposit will consist of detached molecules, and most likely of a compound of copper and hydrogen. This would not occur if the current also were weak, because a weak current means a low tension at the electrode, and hydrogen can be set free only when a certain tension has been reached, sufficient to supply the requisite specific

energy; besides, the slow current would be able to find sufficient copper in even a very dilute solution.

It is obvious, therefore, that solutions should be sufficiently supplied with metal for all likely requirements, and the stronger they are the more rapidly they are to be worked.

The other point to be studied is the relation of the current to the solution and to the work, and this the most important, because it is under control and is constantly varying with different objects. We have seen that there is a point so near balance that the extra strength of current concentrated on the edges destroys the coherence of the deposit. Now, if we arrange several vessels in series, all alike except in the difference in the area of the cathode in each, and connect them to a battery, we can produce such a condition of things that, by the same current and from the same solution, and with the same size of anode, we shall obtain every gradation of deposit, from brown loose powder to single hard crystals. Here, then, we find a relation between the quantity, or current, and the area over which it is distributed—a relation which is rarely pointed out with the definiteness required, for this is the fundamental condition of good working. Of course this is practically known, or there could be no success in depositing, but the principle can only be understood by a distinct conception of measurement and of the molecular relations of electricity.

This relation we may examine under the name of density of current, for which also we require a unit; this is conveniently furnished by the chemic unit of current and square inch of surface. We must therefore ascertain, by experiment, for any given solution, the range of density of current which gives good work. Such an experiment is made by using a cathode of a fixed area, so that by varying the battery power we can examine the different quality of deposit produced. Having thus ascertained the rate of deposit adapted to the solution, the density of current can be controlled by similar means in actual working, so as to secure the conditions of good working and the rate and quality of deposit we desire.

DECISIONS OF THE COURTS.

United States Circuit Court.—Northern District of Ohio.

CLOVER SEED MACHINE PATENT.—JOHN C. BIRDSELL *vs.* A. MCDONALD *et al.* JOHN C. BIRDSELL *vs.* THE ASHLAND MACHINE COMPANY *et al.*

[April term, 1874.]

SWAYNE, *J.*:

These are suits in equity founded upon certain patents issued to the complainant, touching machinery for getting out clover seed. Except in one particular, hereinafter mentioned, the bills in both cases contain the same allegations.

The parties agree as to the state of the art down to the period of the alleged inventions of the complainant.

Before that time clover heads were detached from the stems, preparatory to hulling, by the tramping of horses, by thrashing with flails, by cutting with cradles (the two first fingers being covered with canvas and the heads cut off near the place of their attachment to the stems), by removing the heads in the field by an instrument known as a stripper, and, after mowing, by ordinary thrashing machines. The heads were also sometimes detached by a machine designed especially for that purpose. Hulling out the seed was a distinct process. This was usually done by a machine used for that purpose alone. Machines for thrashing and those for hulling were frequently worked at the same time side by side. *

The complainant's bill against McDonald and others is founded upon two patents, reissue No. 1,299, and the original patent, No. 35,209. The bill charges the defendants in that case with infringing all the claims, three in number, of the reissue, and the third claim of the original patent. *

A patentee cannot be charged with having abandoned his invention because his solicitors, without his knowledge, neglected to file his application in the Patent Office, for more than two years after it had been sworn to, and was in all respects complete.

An invention will not be held forfeited because it was used for experimental purposes, in good faith, more than two years before applying for a patent. The objection is not one to be regarded with favor; but, if clearly established, it is fatal.

It is presumed, from the decision of the Commissioner of Patents, in granting a reissue, that it embraces the same invention as the original patent; and the contrary can be shown only by a comparison of the papers in the two cases.

A reissued patent can only be impeached for fraud by a bill in equity brought for the purpose by the Government.

A combination is legitimate when all the elements coöperate in producing a result, and are necessary to it, though their several functions are not performed simultaneously; if performed in immediate succession, it is sufficient.

If an alleged invention proves superior to what has been known before, it is evidence in favor of its novelty.

A clover machine with two hulling cylinders does not affect the validity of a subsequent patent for a machine for one cylinder for thrashing and another for hulling.

Machines which have been abandoned after being experimented upon do not prejudice a subsequent patent for a successful machine, however closely they resemble each other.

[*S. S. Fisher*, for complainant.
George Willey and *George Rex*, for defendants.]

Recent American and Foreign Patents.

Improved Sash Balance.

Newton J. Skaggs, Talladega, Ala.—By suitable construction a cord is pressed and clamped against the side bar of the sash by the downward movement of the block into the cavity of a plate. The block is raised to release the cord by means of a knob, the stem of which passes in through a vertical slot in the angle of the plate, and is screwed into the block.

Machine for Rolling Blanks for Nut Bars.

George Johnson, Haverstraw, New York.—This invention consists of a revolving clearer having notches in its periphery, in combination with a pair of rolls for rolling notched bars. The notches of the clearer correspond to the notches in the rolls for forming the hexagonal nuts, so as to mesh with the notches in the soft, hot iron as it is received and discharged by the clearer.

Improved Water Elevator.

Henry M. Sweet, East Haddam, Conn.—The shaft passes through a box flange which is attached to the brake lever. This box flange is made to slide in a slot of a curb sufficiently to throw a pinion out of gear with a wheel. The pinion is thrown out of gear, at the same time that the brake is applied, by manipulating a lever, by means of which the bucket may be stopped, when full of water, at any desired point.

Improved Garter.

Samuel Chard, Mianus, Conn.—This consists of an outside spring band and an inside adjusting band, severed at one point, and connected together. The inner band will be made a little less in circumference than the limb which it is designed to clasp. It is placed over the top of the stocking, and exerts, through the spring band, a gentle pressure sufficient to hold the stocking securely to the leg.

Improved Running Gear for Wagons.

William H. Simmons, Memphis, Tenn.—This invention consists in connecting the reach to the front running gear by means of a tube through which the king bolt passes. The tube is secured to the axle independently, and thus relieves the king bolt of strain.

Improved Holding Jack for Wagon Bodies.

William R. Crane, Stony Creek, Mich.—This invention consists of a couple of rests for the support of a wagon body, mounted on a horizontal support, one being jointed and the other attached to it. Said support is mounted on the top of a standard, in which it is capable of turning on its axis. The standard turns on its axis, so that the box may be turned and shifted about, and presented and held in various positions for the convenience of the workmen in dressing, finishing, and painting it.

Improved Adjustable Dead Pulley.

Augustus Newell and Asa B. Cook, of Erie, Pa.; said Newell assignor to said Cook.—The loose pulley is entirely supported by the box, there being a space left around the shaft. The two arms of the double hanger are held against the sides of the box by means of a bolt, which passes through the lower extremity of the said arms. The double cam of the shifting lever, as it moves the loose pulley in and out, presses the rim of said pulley against the rim of the fast pulley, thereby causing sufficient friction between the pulleys to impart motion to the loose pulley, said motion being requisite to facilitate the shifting of the belt. A completion of the movement of the lever withdraws the pulley from contact with the other pulley, and leaves it at rest. The opposite movement of the lever applies the friction as before, shifts the belt to the loose pulley, and allows it and the belt to come to a rest.

Improved Rotary Evaporator.

Adrien Queru, Marlborough, N. Y.—The tubular arms of a revolving carrier support heating pipes, which are arranged parallel with the shaft, so that the water will flow back to the hollow hub. They are arranged also in clusters, by connecting them at each end to a hollow ring. Partitions in the hubs and hollow axle prevent the water of condensation from running back into the lower portions of the hubs; they also separate the steam on entering the pipes. The water will in this arrangement escape directly from the heating pipes by gravity, and thus offer no obstruction to the entrance of the steam; but it will not escape until the pipes rise above the horizontal plane of the axis, so that the partitions will keep it from falling to the bottom of the hubs, and will cause it to flow out at the escape side through the hollow shaft. By the separation of the hub into which the steam enters, the steam is divided and applied equally to all parts of the evaporator. The steam enters at one side, and the water escapes at the other. This apparatus is applicable to use in vacuum pans, both as a heater and agitator.

Improved Truss Bridge.

John L. Miner, Brenham, Tex.—The object of this invention is to provide a strong and cheap bridge of improved form. The stringers which are bolted to the pier caps are formed by bolting two parallel beams to each other. They are connected by two sets of zigzag braces, placed the one set at the upper part, and the other set at the lower part, of said stringers, the braces of the two sets crossing each other at their centers. The two stringers are secured to each other by tie rods having a washer and head at one end and a washer and nut at the other end, the said tie rods passing through the space between the two sets of braces. The side walls of the bridge are formed of wall plates, braces, and tie rods. The cap plate is made in three parts, the central part being parallel with the stringers, and at a distance above them of fifteen feet or more. The end parts of the cap plates are inclined, and extend to the ends of and are bolted to the said stringers. The tie rods are vertical, pass through the stringers and through the cap plates, near the upper ends of the braces, and have washers and heads upon their lower ends, and washers and nuts upon their upper ends. The girders are attached to the stringers, and, in connection with the joists, support the planks that form the road bed.

Improved Illuminating Roof Plate.

William L. Smith, Jr., P. O. Box 81, Brooklyn, N. Y.—This illuminating tile is made of malleable metal, so as to make it lighter and less liable to break than when made of cast iron. Holes are formed in a metal sheet with collars in it of a size to suit the glass. Another sheet is added, in which holes are made of a size to prevent the glass from falling through, thus forming seats for the glass to rest upon. The holes in the two sheets are punched, so as to correspond with each other in position, and the two sheets are fastened together.

Improved Hoe.

William Moore Faunt Le Roy, Fredericksburg, Va.—This invention consists in making the handle adjustable with regard to the blade to suit the various purposes for which hoes of various kinds, as well as shovels, are used.

Improved Wagon Jack.

Frank Judson, Des Arc, Ark.—For operating the jack, a lever is raised as far as it will allow, and a catch is placed as far out on the rack of the lever as possible. The lever is then pressed downward to raise the center post. A pin is placed through the lowest visible hole above the upper part of the standard for sustaining the weight thereon, and the operation of raising the center post is then repeated until the wagon or other object to be hoisted is at the required hight.

Cutting Block Holder for Leather Workers.

Elias P. Newton and Hiram A. Titus, Gloversville, N. Y.—This cutting block holder has adjustable ends provided with pendent extensions and connected by screw rods at top and bottom to provide for longitudinal adjustment.

Improved Weighing Scales.

Henry M. Weaver, Mansfield, O.—These weighing scales may be so adjusted that the net weight of any article placed on the platform may be directly read off at the dial plate. By the position of the weight, a portion of the same is thrown above a horizontal line drawn to connect the pivoted points or edges of swinging bars, so that, by rising above the line, it proportionally loses its power as a counter weight, and causes a pointer to describe equal distances, on a dial plate, when equally increased weights are placed upon the platform.

Improved Grate.

Jonathan Moore, Jr., Brooklyn, N. Y., assignor to himself and Lorenzo D. Longhi, same place.—The bottom portion of the grate is made in two parts, one being a door to which the other part is a frame. A button on the under side of the frame swings under the door and holds it up. The grate can be opened for cleaning it out without the aid of a lever, the button being readily turned by the fire hook, shovel, or any instrument. The hinges are protected from the ashes and cinders.

Improved Horse Detacher.

Anatole Ehret, Telegraph City, Cal.—The traces have loops by which they are hitched to hinged bolts at the ends of the singletrees. A spring catch is thrown by a spring in front of the hinged bolt, to hold the bolt in position for confining the trace. The spring catches are connected with sway bars by chains. When a lever is pushed outward, the effect is to draw back the spring catches, which detaches the traces from the singletrees.

Improved Soldering Machine.

William D. Brooks, Baltimore, Md.—This invention relates to that class of soldering machines which inject a flame upon can joints, so as to melt the solder and allow it to be uniformly disseminated along the seam, whether it be in soldering the cap, top, or side seam. The invention consists in providing, on a burner end or gas outlet of the compound blowpipe, a continuous slot or opening, so that all parts of the seam may simultaneously receive the same quantum of heat and its due proportion of solder, a perfect and reliable joint being thus always formed.

Improved Gate Hinge.

Stephen G. Peabody, Champaign, Ill., assignor to himself and Lyman D. Chaddon, same place.—This is a hinge for gates, heavy doors, etc., so constructed as to prevent water from entering about the pintle, and also self-closing. Concentric cups are formed upon the adjacent ends of the parts of the hinge. In one cup is placed a coiled spring, which causes the hinge to close itself when released.

Improved Apparatus for Making Extracts.

Julius Robert, Gross Selowitz, Austria, assignor to Otto Kratz and R. Sieg, New Orleans, La.—This is an improved arrangement of extractors in a single battery, together with conducting and connecting pipes and heaters, for making extracts of juice from plants, by the process of diffusion, as described in the patent granted to the same inventor, October 30, 1866. The plants are first cut into thin slices and placed in extractors, together with water, and allowed to stand for a short time, when the juice is replaced by other juices of less strength than the remaining juice in the cells of the plants, and so on, until all the juice is extracted. The thick juice is drawn off to the factory, for the subsequent treatment; while the thin juices are passed through the heaters for being warmed, to be used for other diffusions, until made thick enough to be conducted away. By suitable arrangement of pipes and connections, the operation is carried on continuously and in succession in all the different stages without interference of one with another.

Improved Guide Wheel for Car Trucks.

Nathan M. Hale, Cleburne, Texas.—This invention consists in supporting horizontal wheels that run under the flanges of a central T rail on springs, the elasticity of which allows the wheels to rise and pass any obstacle without stopping the car or injuring the track. This allows the wheels to be fastened to the cow catcher, and renders unnecessary the elevation of the main rails to an equality with the central one.

Improved Double Cultivator.

James M. Holladay, Twyman's Store, Va.—This invention relates to certain improvements in double cultivators. It consists in the peculiar construction of devices for adjusting the tongue or pole from the rear for the purpose of adapting the implement to hillside cultivation, and also in the peculiar construction and arrangement of the parts of a traction frame, so jointed and attached to the carriage as to admit of the cultivator proper being lifted from the ground and suspended about the axle for the purpose of transportation. It consists, further, in the manner of pivoting the traction frames so as to adjust the cultivator laterally to the irregularities of the row, and to deep or shallow cultivation.

Improved Paint Brush.

Etienne X. Thiercelin, Shark River, N. J.—This invention consists of a tapering handle with metallic socket, connected by guide strips or prongs of the same with the top and side part of the outer bristle binding socket, after the handle has been carried centrally through the bristles to strengthen it and make it more durable.

Machine for Smoothing and Cornering Panels.

Jacob P. Beck and John H. Weaver, Lock Haven, Pa., assignors of one third their right to A. N. Raub, same place.—This is an improved machine for smoothing and cornering panels, so that the sandpapering of the raised part at one side thereof may be obtained, at the same time with the broad level portion at the other side, by mechanical means in place of by hand work. There are vertically rotating heads, with detachably inserted pads, covered with sand paper for smoothing both sides of the panel, and adjustable detachable bits for cornering the same. The revolving heads work on separate mandrels, one being laterally adjustable to the thickness of the panel, and the other being capable of vertical adjustment on an arc-shaped guide support.

Improved Machine for Driving Brush Handles.

John Ames, Jr., Lansingburgh, N. Y.—In this machine devices are provided for driving all the brush handles of the same lot to exactly the same point. The ferrule of the brush is held and supported while the handle is being driven. By means of weighted cords a tube is forced up through the brush head. Within the tube is placed a rod, the upper end of which is pointed so as to open a way for the said tube through the brush head. The rod is supported in the tube by a coiled spring. The tube and rod moves upward through the brush head, and strikes against a stop. This leaves the upper end of the cavity of the tube empty to receive the point of the brush handle, the other end of which rests against the lower end of the driver. The driver is then forced downward by operating a hand wheel, which forces the brush handle through the brush head. As the point of the brush handle passes down through the brush head and through the table, it is received in the concaved upper end of a short tube, through which the other tube passes, and all the parts are carried down together by the continued descent of the handle. By suitable arrangement, when the brush has been removed and another brush head arranged in the thimble, a slight pressure with the operator's foot upon the end of a bent lever will release the tube, and allow it and the pointed rod to be forced up through the brush head by the weights.

Improved Knob Spindle Fastener.

Eugene F. Lincoln, Boston, Mass., assignor to himself and John C. Hancock, same place.—This invention consists of a little slide bolt inside of the rose plate, to lock the knob spindle by sliding into a notch in the edge of a disk on the spindle. The said slide has a pawl with a handle pivoted to it, so as to drop into the slot of the escutcheon plate, through which it projects, to lock the bolt when shoved forward. There is also a spring for throwing it back when the pawl is pulled out of the slot to release the slide bolt. The object is to provide a simple inside lock for fastening the door of water and other closets, sleeping rooms, etc., temporarily, without having to change the key from one side of the door to the other.

Improved Seedlings Puller.

John S. Swaney, Marengo, Iowa.—As the machine is drawn forward, the jaws are opened to allow the plants to pass between them, and to grasp the said plants and draw their roots from the ground. As the jaws are again opened by the opener, the plants will drop into a concavity formed in the frame, whence they are taken by an attendant and bound. As the plants pass up at the rear side of a wheel, they are struck by a horizontal rod which has a rapid up and down movement. By this device all the soil is knocked off the roots of the plants before they are dropped into the receiver.

Improved Machine for Rubbing Oil Cloths.

Charles Rommel and William H. Crane, Elizabeth, N. J., assignors to themselves and Wisner H. Townsend.—This invention consists of a reciprocating rubber, to which simultaneous revolving motion is imparted by its connection with a shaft with cranks arranged in opposite direction. The rubber frame supports the pumicestone blocks on a sliding interior frame, which is hung to a roller with handle, to be readily raised with the pumicestones, for admitting the cloth below the same.

Improved Car Axle Box Support.

Charles Billmeyer, York, Pa.—This invention relates to that class of trucks which are intended for narrow gage roads, and which are let down, as respects the axle boxes and the load, so as to prevent the center of gravity, on a tilt, from passing outside the rails and thus overturning the cars.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

Agricultural Implements, Farm Machinery, Seeds, Fertilizers. R. H. Allen & Co., 189 & 191 Water St., N.Y.

Wanted to Manufacture, on Royalty, a useful Patent, of Iron. Address Benjamin Tabers, South Camden, N. J.

Manufacturers of small Steam Pumps with Boiler, send circular and price to A. L. Henderer, Wilmington, Del.

For Power Hammers or Bolt Headers, the best, S. C. Forsaith & Co., Manchester, N. H.

Foot Lathes. Wm. E. Lewis, Cleveland, Ohio.

Address W. H. Rishel, Danville, Pa., Agent for the Sale of Patents.

Foot Lathe, new, Baldwin's make. Will be sold cheap. Address D. H. Stephens, Riverton, Conn.

Wanted the address of makers of the shingle machine which cuts with a thin knife, weighted to prevent bending. F. L. Johns, Calcutta, Clay Co., Ind.

Second hand Horizontal Engine, 28 in. x 60, for Sale. Apply to Watts, Campbell & Co., Newark, N. J.

Every metal worker should have a Universal Hand Planer. For Catalogue, J. E. Suitterlin, Manufacturer, 60 Duane Street, New York.

John W. Hill, Mechanical Engineer, Dayton, Ohio. Drawings, opinions, and advice.

Price only three dollars—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 263 Broadway, New York.

Cast Iron Sinks, Wash Stands, Drain Pipe, and Sewer traps. Send for Price List. Bailey, Farrell & Co., Pittsburgh, Pa.

Pratt's Liquid Paint Dryer and White Japan surpasses the English Patent Dryers and Brown Japan in color, quality, and price. Send for descriptive circular to A. W. Pratt & Co., 53 Fulton Street, New York.

Rue's "Little Giant" Injectors, Cheapest and Best Boiler Feeder in the market. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, &c.

Many New England Manufactories have Gas Works, which light them at one fourth the cost of coal gas. For particulars, address Providence Steam and Gas Pipe Co., Providence, R. I.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Scale in Steam Boilers.—I will remove and prevent Scale in any Steam Boiler, and make no charge until the work is found satisfactory. George W. Lord, Philadelphia, Pa.

For the best Cotton Cans and Galvanized Fire Pails, address James Hill, Providence, R. I.

For small size Screw Cutting Engine Lathes and Drill Lathes, address Star Tool Co., Providence, R. I.

Mechanical Expert in Patent Cases. T. D. Stetson, 23 Murray St., New York.

For the best Portable Engine in the world, address Baxter Steam Engine Co., 18 Park Place, New York.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement. Andrews' Patent, inside page.

All Fruit-can Tools, Ferracute, Bridgeton, N. J.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Iron Frame Band Saws, cheapest and best, $150. Address S. C. Forsaith & Co., Manchester, N. H.

Brown's Coalyard Quarry and Contractor's Apparatus for hoisting and conveying materials by iron cable. W. D. Andrews & Bro., 414 Water St., New York.

Deane's Patent Steam Pump—for all purposes—Strictly first class and reliable. Send for circular. W. L. Chase & Co., 93 & 97 Liberty St., New York.

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Answers to Correspondents

H. K. will find a recipe for cement for grindstones on p. 251, vol. 31.—J. H. B. will find a recipe for hard cement on p. 9, vol. 879, and a description of porcelain on p. 3, vol. 30.—F. W. D. will find an explanation of the shirt polish mystery on p. 203, vol. 31.—F. H. M. will find a recipe for a silver plating solution on p. 299, vol. 31.—J. F. will find that a process of tempering mill picks is detailed on p. 202, vol. 31.—G. R. L. C. will find directions for mounting chromos on p. 91, vol. 31.—C. H. F. will find directions for preserving iron from rust on p. 299, vol. 31; for painting brick walls on p. 346, vol. 31.—W. H. M. can clean chamois skins by the process detailed on p. 91, vol. 31.—W. H. K. will find a description of the cultivation of the castor bean on p. 325, vol. 31.

(1) J. S. S. says: I contend that if two casks are put on an equal level, and a one inch pipe is fastened airtight in the head of one end, and a 12 inch pipe similarly in the other, each pipe being 50 feet high and filled with water, the pressure will be as much in one disk as the other. Is this so? A. The pressure on equal and similar areas in the two casks will be the same.

(2) J. C. asks: Can you tell what to put on albumenized paper to remove the gloss, so that water colors can remain on the surface? A. Try gentle steaming.

(3) G. V. says: I intend to pump water for irrigation. I have to carry the water 600 feet in an open tank or trough, the amount of water to be pumped being 1,000 gallons per minute. I can afford to give it a fall of 3 inches in the whole. What should be the dimensions of the trunk? A. Give the trunk from 1½ to 2 times the cross section of the discharge pipe of the pump. 2. Would pine lumber 1 inch thick be heavy enough? A. Yes.

(4) D. J. T. asks: 1. What percentage of boiler pressure is the mean effective pressure on piston in an ordinary slide valve engine with throttle valve wide open? A. From 75 to 80 per cent. 2. I have been running for eighteen months an engine with 10x16 inches cylinder, and I notice that some of the bolts that hold the face plate to steam chest, also to cylinder head and piston head cap, are being cut away as if by acid; some of them are reduced to about one half their original size. The part affected is that which passes through the steam chest plate, the piston head cap, and the cylinder head. It is not rust, for the parts have been kept perfectly well lubricated. Can you tell me the cause and a remedy? A. Probably caused by water carried over with the steam, in which case the use of dry steam will be a preventive.

How can I make a first class Babbitt metal? A. You will have to experiment to get the metal right. See p. 384, vol. 29.

(5) E. P. asks: What process is used in casting steel or iron into ingots, so as to prevent blow holes on the outer surface? The process I have used is casting through a sprue into bottom of mold, causing metal to flow upward. This process is not satisfactory, and I wish to know how it can be remedied. A. Make your mold with a long neck, into which the air may rise and leave the blowholes in the top part of the casting, which is to be cut off.

(6) J. A. T. asks: I desire to construct a reflector telescope. 1. Can ground specula be procured in this country, 4½ or 6½ inches in diameter? A. Yes. 2. What would be the probable cost of a 4½ or 6½ inch speculum? A. For silvered glass mirrors, parabolized, $40 for each square decimeter (4 inches) of surface. The focus is six times the diameter, and the highest power equals twice the aperture expressed in millimeters (fifty per inch). 3. Could you give me a full explanation of the construction of small sized reflectors? A. The English have devoted much talent and money to the construction of reflectors without adequate results. The diagonal plane of the Newtonian obstructs the best part of the mirror, and its supports add diffraction wings to the image of a star. Still the silvered mirror costs but one fifth, and its power is nearly five sixths, of that of the achromatic of like aperture.

(7) C. asks: Does a fence over a hill contain exactly as many pickets as a fence on level ground, between the same points, the pickets being the same distance apart? A. Yes.

(8) M. asks: What do opticians mean by immersion lenses? A. An immersion lens is a microscopic objective which has its front and back combinations so adjusted that a film of water, joining the front surface and the thin glass cover of the object, completes the correction for spherical aberration, which correction depends in a dry objective upon the thickness of the front lens. Objectives of 1-10 inch and shorter focus are made to work either dry or with immersion by a screw collar adjustment.

(9) Z. T. K. asks: What is the horse power of an undershot or current water wheel 30 feet in diameter, of 15 feet face and 3 feet deep, running in a current which moves 3 miles an hour? A. Multiply 0·384 times the square of the velocity of the water in feet per second, and divide by 35,420. As to your other query, see article on friction of water in pipes, p. 48, vol. 29.

(10) T. C. W says: I melted 1 lb. resin and 1 lb. pitch together, in an iron vessel; then, while hot, I poured the contents of the vessel into a wooden mold, in the shape of a brick. But I found, after the mixture got cold and hard, that I could not get it out of the mold; it adhered to the wood. Please to tell me how to construct a mold so that the substance will readily come out when cold and not adhere to the mold. A. Try coating the mold with paraffin.

(11) M. H. P. says: We use in our kerosene lamps a powder which prevents breaking of chimneys. It is said to destroy the naphtha. Can you inform me of any ingredients that will answer the above purpose? A. You do not state the mode of applying the powder in question. If you will send us a sample of the powder and a description of the mode of application, we will endeavor to answer your question.

Is there a cement for mending cracks in iron pots? A. Try glycerin and litharge.

(12) E. C. H. asks: What ingredient in soap is it that, when coming in contact with the eyes or an abrasion of the skin, causes it to smart? A. The alkali it contains. 2. Can there be manufactured an effective article of soap tha twill not cause such pain? A. No.

Which would be the most serviceable application for ordinary New Jersey yellow pine weather boarding, lime, whitewash, or coal tar, and which would be the coolest in hot weather? A. The whitewash.

(13) S. H. T. asks: What is the mode of etching engravings, etc., on glass? A. See our answer to P. M., No. 4, p. 298, vol. 31. The printing ink protects the glass with which it is in contact from the corroding action of the acid. Mr. Napier, the patentee, prefers to have the glass ground enameled or veneered beforehand, when the objects stand out in relief. If the veneer or enamel is colored, of course the picture remains colored, while the body of the glass is white. This also answers J. G. G.

(14) J. H. asks: How much more power, if any, will be required to turn a wheel one foot in diameter four times around than to turn a wheel 4 feet in diameter once round in the same time? A. Multiply the resistance by the distance through which it is overcome in each case, which will give you measures of the power exerted in turning the two wheels.

(15) J. C. D. says: I wish to run my sewing machine by water power, and propose the following plan: A water wheel 15 inches in diameter, inclosed in a watertight case, to be adjusted under the table of the machine, with a tank, resting 20 feet above the floor and 30 feet on a horizontal line. The tank to hold about 200 gallons, with a pipe leading to the wheel 1½ inches in diameter. The jet from this pipe to be ¼ inch in diameter, and strike the water wheel at about 45° below the line of the shaft; a discharge pipe to be adjusted at the bottom of the wheel case. Will this run the machine for ordinary domestic sewing? A. This plan will doubtless answer well.

(16) W. H. G. asks: If a loaded ship, afloat, were elevated one half the number of feet which it draws, would it capsize? A. Generally it would; but the load might be so disposed that the ship would remain upright.

(17) A. M. asks: By what process are raisins manufactured? Can the grapes grown in this part of the world be used for this purpose? B. The grapes are dried, either in the sun or in ovens. We do not think it likely that raisins made from the grapes of this country would compare very favorably with those that are imported. We cannot refer you to any work especially devoted to this subject.

(18) J. N. & S. say: We want to drive a shaft at a right angle to our line shaft, and wish to know if we can do it with friction pulleys. The speed of line shaft is 300 per minute. Of what material and how should the pulleys be constructed? A. You can do it with friction pulleys, made of cast iron, if you have sufficient surface.

(19) M. F. D. asks: 1. How shall I make a dry rose madder suitable for painting on wax for flowers? A. Inclose 2 ozs. troy of the finest Dutch madder in a bag of fine and strong calico, large enough to hold three or four times as much. Put it into a marble or porcelain mortar, and pour on to it a pint of clear soft cold water. Press the bag in every direction, and pound and rub it about with the pestle, as much as can be done without tearing it, and when the water is loaded with color pour it off. Repeat the process until the water comes off but slightly tinged, for which about 5 pints will be sufficient. Heat all the liquor in an earthen vessel till it is near boiling, and then pour it into a large basin, into which place 1 oz. of pulverized alum; stir the mixture for a short time, and while stirring pour in gently about 1½ ozs. of a saturated solution of subcarbonate of potash; let it stand till cold, to settle; pour off the clear yellow liquor, add to the precipitate a quart of boiling water, stirring it well; and when cold separate by filtration the lake, which should weigh ½ an oz. Fresh madder root is superior to the dry. 2. How shall I make cadmium yellow for the same purpose? A. Cadmium yellow (sulphide of cadmium) is a compound of sulphur and cadmium. It is obtained by precipitation from a salt of cadmium by a current of sulphuretted hydrogen gas, or by an alkaline carbonate.

(20) J. N. P. says: The copper mines in the mountains of East Tennessee are second to very few in the country. I recently observed a precipitating process which interested me very much. Two shafts have been sunk to a depth of fifty or sixty feet, and a stream of so-called "copper water" has been struck. Pumps are inserted, and this water is pumped into a very long trough, running nearly level. Into this trough is put a lot of old scrap iron. Every twenty or thirty feet along the trough are pits, about two feet deep, into which the precipitated copper is swept. It is then shoveled out and is ready for the refinery. 1. Of what does this water consist? What is the proper name of it? A. A solution of sulphate of copper in water, and probably proceeds from the oxidation of copper pyrites (sulphide of copper). This solution is commonly called blue vitriol. 2. If the residue is the copper precipitated from the water, what becomes of the iron? A. The iron takes the place of the copper in solution. 3. What is the proper name of the water after the copper is taken out? A. The solution of sulphate of iron is called green vitriol.

In certain parts of the country adjacent to the mines, there prevails among the cattle a disease which the natives call milk sickness; they say the cattle never have it unless they have been feeding in dark caves or places in the mountains where the sun seldom shines. To what is it attributable? A. Probably to some poisonous substance contained in the water, which could be determined by an analysis.

(21) W. S. B. asks: 1. Has science ever given a decided answer as to the cause of the Gulf Stream? A. It is due to the flow of the heated waters of the torrid zone towards the poles, the direction of the flow being influenced by the earth's rotation and the forms of the continents. 2. How swiftly does it flow, and how wide is its current? A. The maximum velocity of the Gulf Stream is five miles an hour, and the average less than one and a half.

(22) J. W. asks: 1. Does lead contain sulphuric vapors and oxygen vapors? A. No. 2. When lead melts, does it expand and force the vapors off? A. No. 3. When the lead is cooling, does it reabsorb these vapors from the air? A. No.

1. Is there such a thing as malleable glass? A. No. 2. Fluorhydric acid corrodes glass. Is the glass converted into a vapor or into silicic acid? A. It attacks the silicic acid in the glass, combining with it to form hydrofluo-silicic acid. 3. Can the glass be obtained by evaporating the fluorhydric acid? A. No.

Do potassium and magnesium combine together? A. No.

If four grains of arsenic and two grains of potassium were combined together, would the combination be green? A. No.

(23) P. E. V., of Paris, France, asks: 1. Will you please give more precise details for preparing the waterproof paper described on p. 146, vol. 31? I have tried the process, but failed. A. A concentrated solution of borax in warm water should be made, to which is added the shellac in a fine powder. The paper, after saturation in the solution, may be pressed between rubber rollers and dried. 2. What is aqueous solution of shellac in borax? A. Shellac is the purified resin which exudes from the branches of several trees in tropical climates, and in particular from the *ficus indica*, *ficus religiosa*, and *rhamnus jujuba*. It is soluble in an aqueous solution of borax, by which it may be distinguished from most common resins.

(24) C. B. F. asks: What is the thickness of the earth's outer crust? A. Nothing is definitely known as to this. Some philosophers fix 60 miles as the thickness of the earth's crust, and others imagine it to be 125.

Should cream be allowed to sour before churning? A. No.

1. Is silver better than brass or German silver for a cornet? A. There is some difference of opinion on this subject, but the general belief is that there is no particular advantage in employing silver. 2. What is German silver composed of? A. Copper, zinc, and nickel.

Is gold the heaviest metal? A. No.

Is the centennial tower progressing? A. You should apply to the projectors for information. We have heard nothing of of it, late.

(25) C. E. W. asks: What is the rule for finding the mean of the thermometer when part of the observation are above and a part below zero? A. Add all the negative readings together, and subtract the sum from the sum of the positive readings. Divide the difference by the whole number of readings.

(26) S. K. H. asks: What is oxygenized oil, used for testing olive oil? A. Several oils have the property of absorbing oxygen under certain conditions, among which is boiled linseed oil. This latter may be possibly the oil in question; but no mention can be found, in scientific works, of any oil specifically named oxygenized.

(27) R. S. asks: What is the gas or smell proceeding from newly baked bread? My dwelling is connected with a bake house, and the smell from a large quantity is penetrating, and very disagreeable. Is it unhealthy? A. The smell is due to the escape of the gases and volatile compounds generated from the breadstuff during the process of fermentation, and expelled by the heat. We know of no case where it has proved unwholesome to a marked degree.

How can I determine whether water is poisoned by passing through lead pipe? A. Render the water acid with dilute oil of vitriol, and add sulphuretted hydrogen to it. A black coloration indicates the presence of lead.

When plaster of Paris has been used to fasten the parts of a lamp together, what will soften it so that the parts can be separated? A. Dilute muriatic acid.

(28) N. E. L. says, in reply to Y. M., who has trouble in sucking water with his pump at 200 revolutions: I am using a small engine, and I was told I could not suck water from a well about 20 feet deep with ¾ inch pipe. I put in the pipe; and near the pump in the suction pipe, I put a T joint with about 1 foot of ¾ pipe, with the end soldered up. This serves as a water or air chamber. I have no trouble in running 200 revolutions per minute. J. M. should put in an air chamber about five times the capacity of his pump. A T joint and a piece of pipe may do, but an air chamber, with the water drawn from the bottom and the supply pipe coming in a few inches above, so that, while it is pumping, it will not prevent a steady flow of water into the chamber, will be better. The pump now has to start the water in the whole length of the supply pipe; and in fact, the pump will form a vacuum before the momentum of the water is overcome. With an air chamber, it has only the water from the pump to the air chamber to start,

and the water flows into the air chamber in a steady stream. J. M. may not be able to run at 200, but I think he can go over that. I think the supply pipe is large enough. I hope J. M. will tell through your paper how he succeeds. A. Your hints are practical, and will be of great value to some readers. The air chamber in the supply pipe, however, is not the universal panacea for sulky pumps that you seem to consider it. Still, no one who puts in such an air chamber will have cause to rerget it.

(29) E. L. F. says, in reply to F. S. M. & Co.'s query as to sesquioxide of manganese: The sesquioxide of manganese is found in its anhydrous state as braunite, and in an hydrated state as manganite. It may be obtained by passing chlorine through manganous carbonate, placed in water, and afterwards applying diluted nitric acid to remove the excess of the carbonate.

(30) E. L. F. says, in reply to W. H. R., who asked how to make the muriatic salts of nickel: Pure nickel has a great similarity to iron, both in its external appearance and its combinations, and is regarded as a tetrad, although it forms but one chloride, in which it is bivalent. Nickel chloride ($NiCl_2$) may be prepared by dissolving the oxide or carbonate of nickel in hydrochloric acid. By a simple process, the nickel carbonate may be prepared from the crude *speiss*. Any good work on chemistry explains the method.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Vegetable Fibers. By J. W.
On Hydrocarbons on Iron and Steel. By L. P.
On Solids Floating on Liquids. By A. R.
On Popular Dental Science. By C. S. S.
On a Flying Machine. By C. H. C.
On Boiler Explosions. By R. B.
On Oyster Culture. By O. C.
On Suet Butter. By J. L.
On a New Projectile. By W. L. A.

Also enquiries and answers from the following:

J. G. G.—S. W. R.—E. W. H.—C. A. P.—X. Y. Z.—L. N. K.—W. J. R.—J. W. D.—W. D. D.—F. R. D.—M. L. W.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who erects wire tramways? Who buys broken window glass? Who builds engines and boilers for small boats? Where can spectroscopic apparatus be bought? Who sells photographic chemicals that can be relied on for quick work?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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APPLICATIONS FOR EXTENSION.

Applications have been duly filed and are now pending for the extension of the following letters patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

31,443.—FELLY MACHINE.—C. H. Denison. Feb. 3.
31,445.—LIME KILN.—R. Donaldson. Feb. 3.
31,503.—COAL BREAKER.—R. A. Wilder. Feb. 3.
31,533.—WEIGHING APPARATUS.—A. B. Davis. Feb. 10.
31,534.—SCALE BEAM.—A. B. Davis. Feb. 10.
31,566.—DRYING TUNNELS.—F. H. Smith. Feb. 10.
31,579.—CORN PLANTER.—F. B. Preston. Feb. 10.

EXTENSIONS GRANTED.

30,633.—FIRE ESCAPE.—E. B. Larcher.
30,651.—HARVESTER.—S. W. Tyler.
30,685.—SEED DRILL.—H. Moore.
30,691.—CASTING PLOWSHARES.—F. F. Smith.
30,691.—PLOW.—F. F. Smith.
30,719.—PAPER FOLDER.—C. Chambers, Jr.
30,745.—CULTIVATOR.—N. Messenger.

DISCLAIMERS FILED.

102,462.—COOK STOVE.—J. B. Wilkinson, Troy, N. Y.
155,584.—DRESS PROTECTOR.—H. M. Macdonald, Lowell, Ms.

DESIGNS PATENTED.

7,855 to 7,858.—CARPETS.—R. Allan, Yonkers, N. Y.
7,859 to 7,862.—CUTLERY.—J. D. Frary, New Britain, Conn.
7,863.—COOKING STOVE.—G. G. Richmond, Providence, R. I.
7,864.—BOTTLE.—S. C. Upham, Philadelphia, Pa.
7,865 to 7,869.—SILVER WARE.—G. Wilkinson, Pr'dence, R. I.
7,870.—WINDOW SCREEN.—G. Shatswell, Waukegan, Ill.
7,871.—INKSTAND COVER.—H. C. Wilcox, W. Meriden, Ct.
7,872.—MONUMENT.—H. C. Borgner, Lebanon, Pa.
7,873.—ORGAN CASE.—G. E. Carhart *et al*, Washington, D. C.
7,874 to 7,876.—CARPETS.—F. W. Green, Orange, N. J.
7,877 to 7,884.—CARPETS.—H. Horan, East Orange, N. J.
7,885.—PARLOR HEATER.—A. T. Jones, Stamford, Conn.
7,886.—HOT CLOSET RANGE.—A. T. Jones, Stamford, Ct.
7,887.—CARPET.—L. G. Malkin, New York city.
7,888.—WRITING PAPER.—C. D. Myers *et al.*, N. Y. city.
7,889.—CARPET.—H. Nordmann, New York city.
7,890 & 7,891.—BUTTONS.—H. E. Bostwick, New Milford, Ct.
7,892 to 7,901.—EMBROIDERY.—E. Crisand, New Haven, Ct.
7,902.—FORK HANDLE.—C. Osborne, N. Attleborough, Ms.
7,903.—STATUETTE.—T. J. Pairpoint, Providence, R. I.
7,904.—OILCLOTH.—C. T. & V. E. Meyer, Bergen, N. J.

TRADE MARKS REGISTERED.

2,072.—CHEWING TOBACCO.—Allan *et al.*, Cincinnati, O.
2,073.—STOVE POLISH.—H. A. Bartlett & Co., Phila, Pa.
2,074.—STOVE DRESSING.—B. F. Brown & Co., Boston, Ms.
2,075.—GLOVES.—Harris Bros., New York city.
2,076.—SHIRTINGS.—Naumkeag Steam Co., Salem, Mass.
2,077.—COOK STOVE, ETC.—G. G. Richmond, Pr'dence, R. I.
2,078.—HEALING SALVE.—Stapleton & Co., Springfield, Ms.
2,079.—MEDICINE.—G. Steloff, Cincinnati, O.
2,080.—PERFUMERY, ETC.—J. & E. Atkinson, London, Eng.
2,081 & 2,082.—CORSETS.—L. Coleman & Co., Boston, Mass.
2,083.—CORSET.—Ottenheimer & Co., New York city.
2,084.—SOAP.—Reed & Co., Pittsburgh, Pa.
2,085 to 2,088.—SALT.—Union Pacific Salt Co., S. F'cisco, Cal.
2,089.—TOBACCO.—Frishmuth & Co., Philadelphia, Pa.
2,090.—PILE REMEDY.—C. Mayne, New York city.
2,091.—MEDICINE.—Dr. J. Simms & Son, Wilmington, Del.
2,092.—PICKLES, ETC.—C. G. Summers & Co., Baltimore, Md.
2,093.—SALERATUS.—J. M. Taylor, New York city.
2,094.—SUGAR, ETC.—DeCastro & Donner Co., N. Y. city.
2,095 to 2,097.—WOOLEN GOODS.—Wash. Mills, Lawrence, Ms.
2,098.—GROCERIES.—N. W. Burchell, Washington, D. C.

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